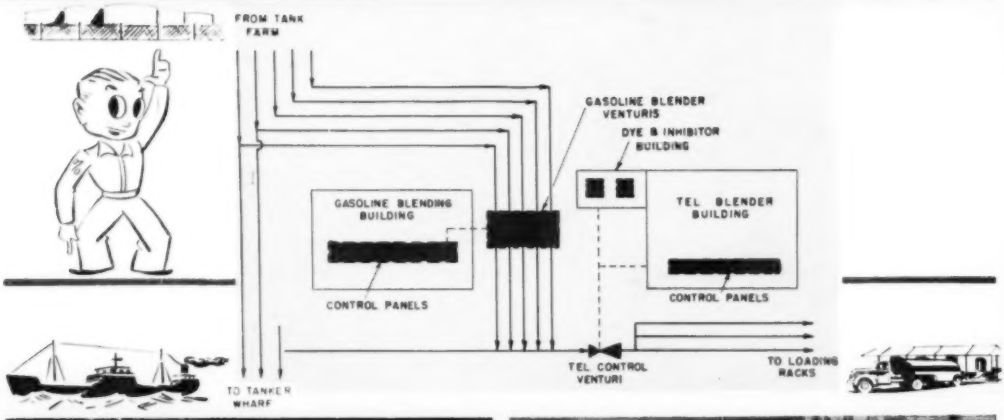
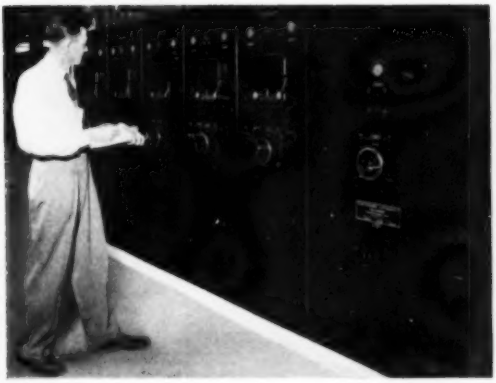
APRIL, 1951
VOL. 6, NO. 4

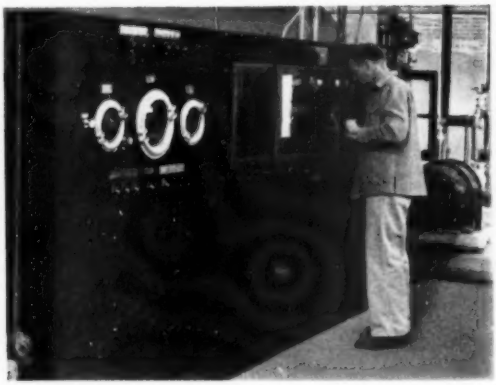
PETROLEUM PROCESSING

"Lost" Valves Get New Lease on Life—p. 388

Blueprint







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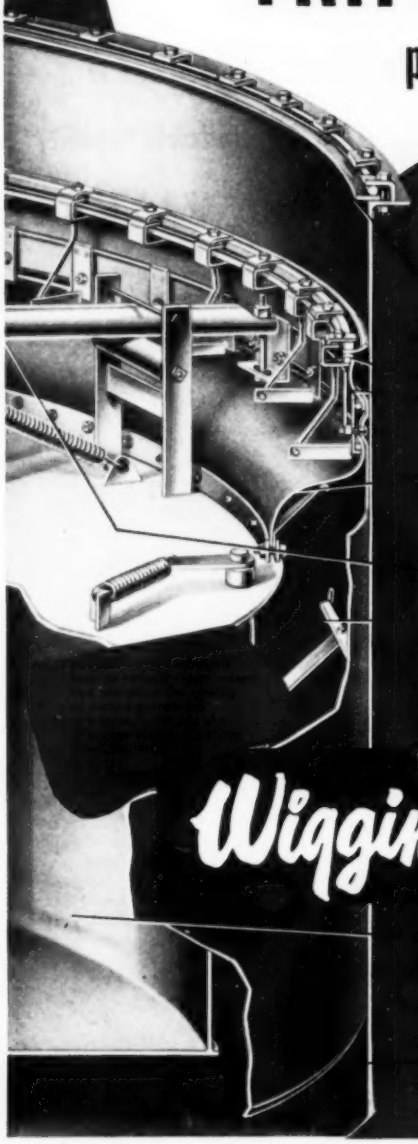

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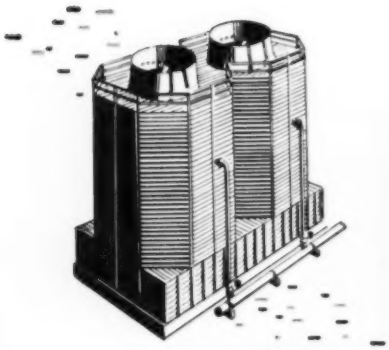

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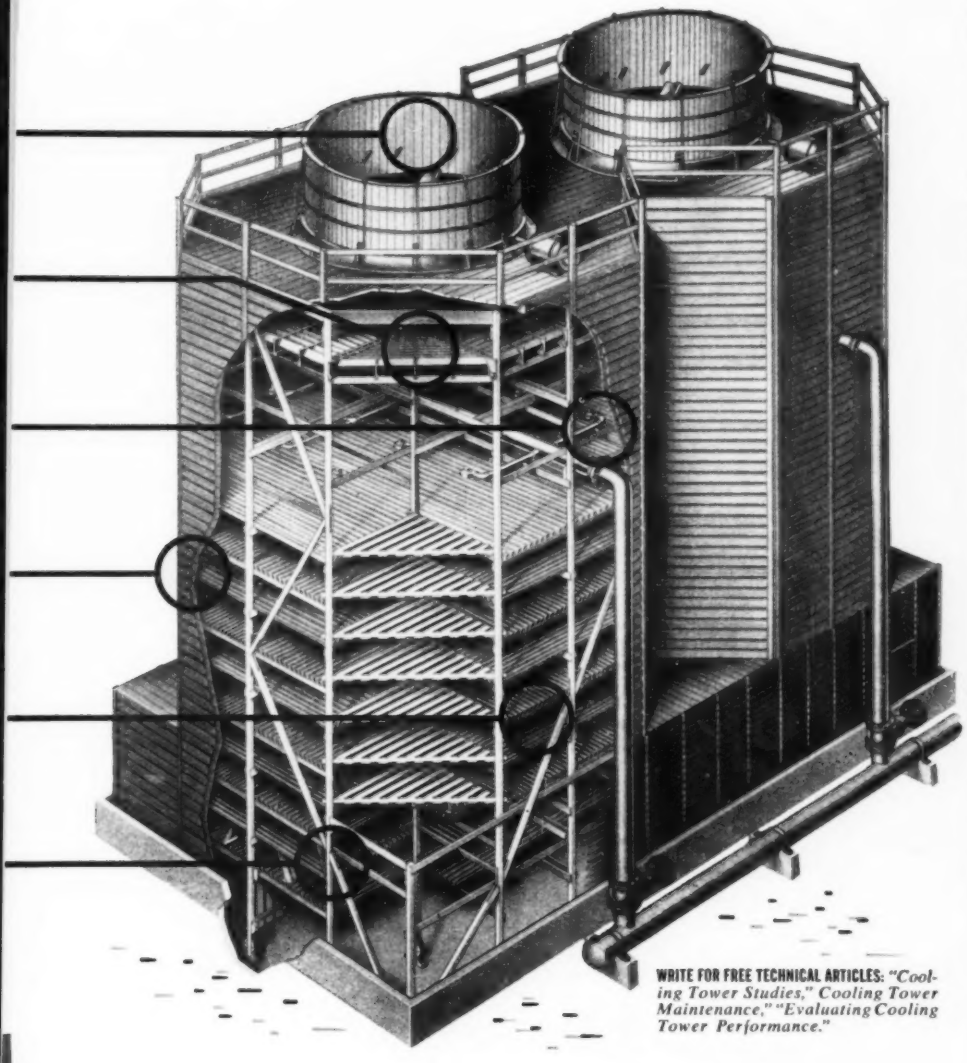

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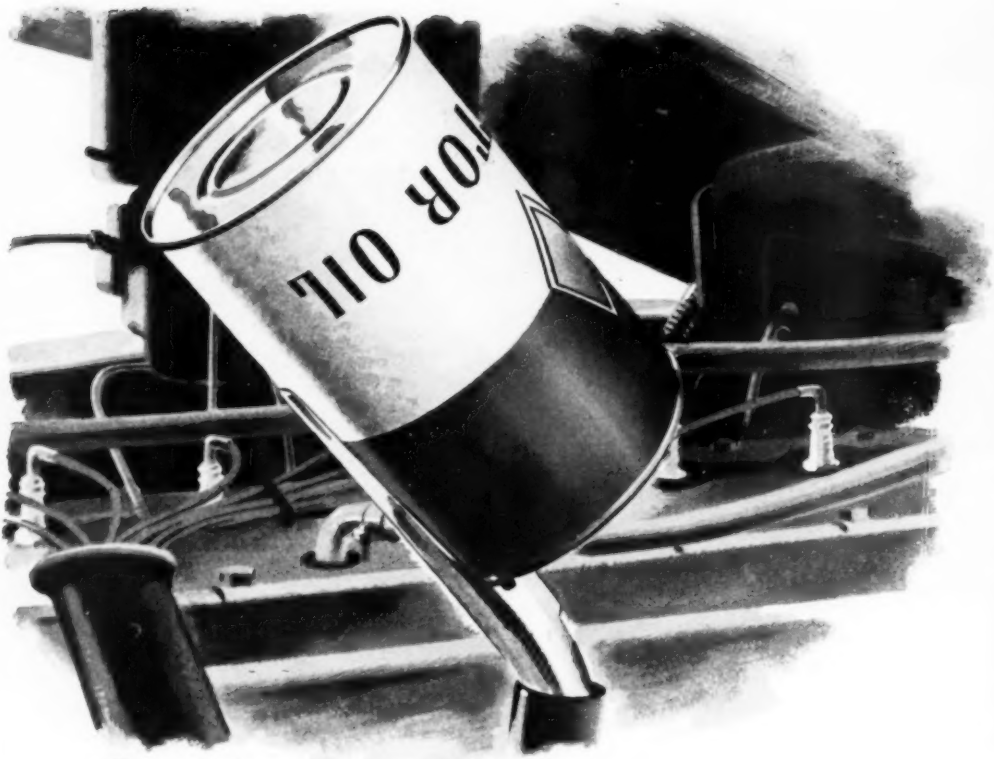

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(*To obtain more data on advertised products see page* 432)

WHAT'S HAPPENING

Current News Summarized For Oil Men

EXPANSION

Cosden Petroleum Corp. is building a 4000 b/d crude still at Big Springs, Texas, to increase crude thruput to 22,000 b/d. Robert L. Purvin cooperated with Cosden's staff in design; construction is being handled by Cosden. Completion is scheduled for July 1. Company is also planning to start construction soon on a 3500-4000 b/d UOP Platforming unit, to be built by Procon, with facilities to recover benzene, toluene and xylene fractions. Completion is scheduled for the summer of 1952.

Phillips Petroleum Co. will increase crude charging capacity at its 4200 b/d Woods Cross, Utah, refinery by an unspecified amount to provide feed for a new 10,000 b/d TCC unit to be installed. Also on the program are vacuum unit, gas recovery plant, refinery office building, and auxiliary facilities—all expected to be in operation by July 1952.

Union Oil Co. of California is installing a 28,500 b/d Fluid unit at its Wilmington, Calif., plant. UOP has design contract; Arthur G. McKee is handling construction. Scheduled completion date is March 1, 1952. Also planned is a 40,000 b/d crude topping and vacuum distillation unit.

Inland Refining Co., Palestine, Texas, will install catalytic polymerization and a 400 b/d Perco Cycloversion unit. Grebe & Doremus Process Co. is doing engineering and construction work.

Pan-Am Southern Corp. will spend $6.5 million in an expansion program at its Destrehan, La., refinery. Present 8000 b/d crude unit will be revamped to 20,000 b/d, and a 12,000 b/d Fluid unit and 2500 b/d sulfuric acid alkylation unit will be installed. Lummus Co. has contract, and completion is expected in about 15 months. Dr. J. W. Bertetti has been appointed asst. general manager of manufacturing to handle the expansion project.

Phillips Oil Co. will install an 8000 b/d airlift TCC catalytic cracking unit at its Okmulgee, Okla. refinery, with Fluor Corp. as contractor. Site clearing has commenced and construction is due to start in June or July.

Imperial Oil has let contract to Canadian Kellogg Co. for part of planned expansion at its Sarnia, Ont., refinery (see PP Feb. p. 103). Contract, for about $9 million, includes 46,500 b/d atmospheric and vacuum distillation unit, 23,250 b/d Fluid unit, and light ends recovery plant.

Imperial Oil Co. will install a "Model IV" Fluid unit at its Edmonton refinery of 11,000 b/d, along with a 9360 b/d vacuum unit for feed preparation. Foster-Wheeler, Ltd., has the contract. "Model IV" Fluid unit, developed by Standard Oil Development Co., is smaller than previous designs, main vessels being less than 100 ft. from grade.

Oriental Refining Co. has begun construction on a 1500 b/d Perco Cycloversion at its Denver, Colo., refinery.

Completions—Petco Corp., 6000 b/d Houdriflow unit at Blue Island, Ill. **Socony-Vacuum Oil Co.,** 15,000 b/d airlift TCC unit at Buffalo, N. Y., replacing a 10,000 b/d Houdry unit. **Magnolia Petroleum Co.,** its third airlift TCC unit at Beaumont, Texas. **Gladewater Refining Co.,** a 600 b/d Cycloversion unit at Gladewater, Texas.

• • •

FOREIGN

Petroleos Mexicanos has announced a self-financed multimillion dollar expansion program for Mexico's refining industry for 1951. Among other projects included are three desulfurization plants, enlargement of plant improvements at Poza Rica, new lube facilities at Salamanca, and construction of a new refinery on the Pacific Coast at an undisclosed location.

Australia's Glen Davis shale oil field in the Blue Mountains of South Wales will be closed, condemned as a "criminal waste of the taxpayers' money." Losses on Glen Davis since work began there 11 years ago have run into millions of dollars, and cost of gasoline produced from Glen Davis shale oil was 56c per gal.

• • •

MARKETS, PRICES

Refiners were winding up the heating season at the end of March, having met full demand for light fuel oils with a little left to spare. Heavy fuel supply was easing up somewhat in interior refining districts,

Information on these pages is obtained through the nation-wide news coverage service of PLATT'S OILGRAM NEWS

but continued tight along the Seaboard. Consensus of refiners, however, was that a large and growing demand for all petroleum products persisted.

For statistics on supply and demand, see "Refining Trends," p. 429 this issue.

Refiners of lubes, petrolatums and wax saw no break in what has been a "seller's market" for some months. Refined wax was somewhat more liberally quoted at New York than in the recent past.

Prices for crude and products were substantially unchanged from February. Crude oil was in tight supply, and a number of Independent refiners reported they were unable to obtain needed supplies of desirable crudes in the Southwest.

Inquiry for gasoline was active, and refiners had a few offerings for prompt shipment, but generally have already committed a large share of their output after April 15.

Struggle to maintain gasoline quality in the face of government restrictions on lead (see March PP, p. 224) was pointed up when shippers in the Great Lakes Pipe Line elected to lower specifications on their premium-grade tenders to 89 Research octane, down one full number, and on regular grade to 81.5 Research octane, down a half number.

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INDUSTRIAL MOBILIZATION

Materials to keep refineries operating can now be obtained under a new MRO program tailored to meet oil industry's specialized needs. The new plan, M-46, is being administered by PAD and has several advantages over the previous Reg. 4 order. For details on how it operates, see p. 365, this issue.

Canada has organized its own PAD—a Petroleum Division of the Department of Trade and Commerce, which will correlate plans for increasing production, refining and transportation facilities, working closely with PAD on problems of common interest. Imperial Oil has loaned its vice president, Dr. O. B. Hopkins, to serve as director of the division. Among assistant directors appointed are D. M. Morrison (manager, Shell Oil Co. refinery at Montreal) as head of the Refining Section, and Harold E. Saunders (supervisor, crude and product purchases, McColl-Frontenac Oil Co., Montreal) as head of the Materials Section.

Materials, not manpower, is biggest problem facing petroleum industry today, according to Bruce K. Brown, deputy PAD administrator. In view of presently known plans for the size of the armed forces, Brown says, "I have been unable to believe that the petroleum industry was going to be stripped of its manpower. On the other hand, I knew that with the impacts of the mobilization program on materials supplies, the petroleum industry was going to be stripped of its materials unless we did something about it. For this reason, we have given our first attention to materials." However, PAD hopes to take up manpower question soon. (For story on how refiners can get materials and lineup of PAD Materials Division, see p. 365.)

Sulfuric acid requirements of petroleum processing industry are being determined by PAD, through a questionnaire sent to all refiners last month. Data sought includes not only end-use needs for the acid, but also the amount of elemental sulfur which could be recovered from spent acid sludges and from refinery and field gas streams. Supply of sulfuric acid now is at least 15% below nation's needs, according to PAD. Last year oil industry accounted for over 12% of total U. S. consumption.

APPOINTMENTS—Charles P. Rather (Southern Natural Gas Co.) as PAD assistant deputy administrator for gas, replacing R. H. Hargrove, who has been serving on a temporary basis . . . **Rolland P. Wood** (Pure Oil Co.) as chief of Marketing Materials branch, PAD's Materials Division . . . **Maj. Gen. Thomas F. Farrell** (U.S.A, inactive) as DPA's deputy administrator for resources expansion, to coordinate all DPA activities in field of government aids to business (direct loans, guaranteed loans, fast tax writeoffs, etc.)

• • •

MISCELLANY

Motor octane ratings for gasoline may be knocked out of ASTM specifications for motor gasoline (ASTM D 439), if ASTM's Committee D-2 on Petroleum Products carries through with present thinking. Research method of rating would be used instead. Proposal arises from the fact that there is some thinking among both consumers and producers of motor fuels that Research ratings are more significant than Motor ratings. Committee has invited comments from anyone interested; address them to W. T. Gunn, secretary, Rm. 2040, 50 W. 50th St., New York 20.

Distribution of standard samples of hydrocarbons and organic sulfur compounds purified by API research projects and certified and bottled at National Bureau of Standards will be handled in the future by Carnegie Institute of Technology. Orders for samples should be sent to the Institute, Pittsburgh 13, Pa., marked for the attention of Dr. Frederick D. Rossini.

Reclaiming used lube oils is the subject of a recent government report—"PB 102130, Application, Reclamation and Re-refining of Used Automotive Crankcase Oils." Report includes domestic and foreign bibliographies, and can be obtained for 25c per copy from Commerce Dept. field offices or by writing to Office of Technical Services, Rm. 6227, Dept. of Commerce, Washington 25, D. C.

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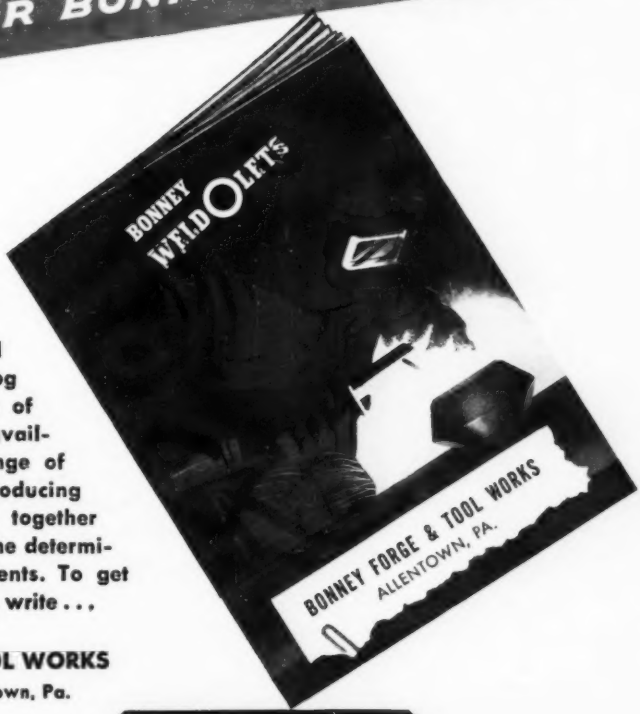

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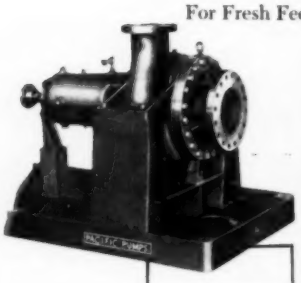

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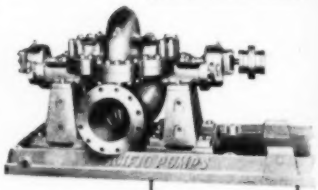

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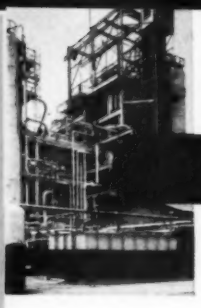

TOMORROW... IN PETROLEUM TECHNOLOGY

Possible Effects of Today's Developments On Future Operations

By the Editors of Petroleum Processing

Further Confusion Concerning HD Oils

THE recent announcement from General Motors that HD (heavy-duty) type oils will be recommended for some of its new models, where such oils are available,[1] is seen by automotive engineers with the oil companies as creating confusion as to when this type oil is actually required. A further disadvantage may be to add to the already existing shortage of some of the metal compounds used as additives for these oils, if more oil companies try to bring their premium oils up to the new HD standards.

Only seven or eight popularly known brands of motor oils now meet the heavy-duty specifications in the old 2-104B military specifications, it is pointed out, and the new MIL 2104 standards are even higher. Oil companies will be hard pressed to obtain extra supplies of the detergent additive to bring their present premium oils up to HD standard, and it is considered that government allocation of some of the additive compounds will be forthcoming if the present situation continues. In fact, it is likely that these materials will be under allocation in any event as the military demand for motor oils increases.

It should be remembered that the high additive oils of the new HD classification were adopted primarily to provide satisfactory engine performance where fuels (both gasoline and diesel) were being used with a sulfur content materially higher than the average found over the country. Except in some limited areas, such high-sulfur content fuels are not now being sold to the public. The use of an HD type oil to protect against the fuel will be needless expense to the motorist in most parts of the country. Also, provided the oil companies can secure the detergent additive materials needed to bring their present premium oils up to the new HD standards, it takes time and considerable expense to run the tests and secure the official HD rating. Lacking this, the interpretation of what constitutes an HD type oil remains with the individual oil company.

It would seem more fitting, under present emergency conditions, for General Motors and other automotive companies to advise the operators of their new models to continue with premium-type oils, even though certain fundamentally design engineering problems might be relieved with the use of the HD oils. In any areas where the type of fuels were being marketed which require engine oils of higher than premium grade quality, the oil companies could be depended upon to see to it that HD or otherwise satisfactory oils were marketed there, as long as it is physically possible for them to supply such oils.

ASTM Planning Early Action On Critical Metals Problems

REFINERS may soon get an assist from the American Society for Testing Materials. Up for final action at the annual Society meeting week of June 18 at Atlantic City are a number of changes in steel and alloy specifications proposed during recent spring Committee Week meetings and developed because of the critical metals situation. Among types of equipment affected are pipe and tubing, structural steel, forgings, boiler and pressure vessel plate, sheets, valves, flanges, and fittings for high and low temperature service.[2]

For example, Subcommittee IX of ASTM Committee A-1 on Steel recommended that the Society issue, post-haste, emergency alternate provisions permitting a higher phosphorus content in certain alloy steels where heavy scrap additions must be made. Producers who must use scrap which may be high in phosphorus stressed emergency action was needed so that more efficient use could be made of alloy steel for still tubes, boiler tubes (seamless and welded), and austenitic seamless and welded tubing for general, refinery, and sanitary service.

An ASTM plan similar to that employed in World War II is anticipated. This involves issuance of "pink slips" which can be affixed to the specifications, and also includes publication of the complete provisions or notice in the ASTM Bulletin. In the steels affected, present phosphorus would be raised from 0.030 to 0.045% as an emergency measure.

Other actions by Subcommittee IX included the incorporation in virtually all pipe and tube specifications of a range of check analysis for chemistry; approval of new specifications on seamless and welded tubes for low temperature service; a new system of grade designations for all specifications; and the addition of new grades of low metalloid ingot iron in specification A 253.

Considerable activity took place in the Committee A-1 on properties and tests of valves, flanges, and fittings. New requirements were approved for austenitic steel castings for service at elevated temperatures and pressures. In standard A 182, covering forgings for flanges and fittings, the current 1% chrome grade will be modified to the more popular 1¼%. A new grade of austenitic steel, Type 304, is to be added to both high and low temperature bolting specifications. In the nut specification, A 194, two grades of nickel-chromium steels using selenium and titanium for free machining and stabilizing will be added.

Most of the new and revised standards are subject to letter ballot in the committees before reference to parent society for action. In general, they will be considered finally at Atlantic City, although some may be approved earlier through the Administrative Committee on Standards.

Reserves of Natural Gas Liquids Steadily Growing

OUR net increase in liquid hydrocarbon reserves in the U. S. in 1950 was 1,157,560,000 bbls., the proved underground reserves added during the year exceeding the volume of liquid hydrocarbons produced by that amount.[3] Of this total added to reserves, crude oil contributed 618,909,000 bbls. and natural gas liquids 538,651,000 bbls.

Total estimated proved reserves of natural gas liquids as of Dec. 31, 1950, were 4,267,663,000 bbls. As a direct result of the discovery of new gas fields in the past few years, our reserves of natural gas liquids have increased about 35% from the 3,163,219 bbls. reserve estimated for 1946, the first year for which data on gas liquids was assembled. In the same period our crude oil reserves in the ground have grown by around 20%.

Our current reserves of natural gas liquids, awaiting eventual use as LP-Gas, natural gasoline and so on, is about 16% of our total crude petroleum reserves of 25,268,000,000 bbls. There is reason to believe that the relative proportion in favor of natural gas liquids will increase somewhat in the future, as it has done in the past, and it is now larger than the current relative production and utilization of natural gas liquids as compared with crude petroleum.

This potential volume of natural

gas liquids held in the ground represents a significant contribution to the conservation of our petroleum and gas resources and its magnitude and importance must necessarily stimulate development work in the petroleum industry to make greater use of the gas liquids.

Sees Mass Output of High Compression Engines

MATERIALLY higher compression engines in automobiles will be forthcoming, according to C. F. Kettering, former vice president of General Motors Corp., and pioneer in research in the automotive field. The petroleum industry is expected to contribute to this trend by supplying higher octane fuels.(4) The higher compression engines (12 to 1) are stated by this authority to be entirely suitable for mass production.

Laboratory and field work with the experimental 12.5 to 1 compression engine, brought out a few years ago, has established two facts: (1) it is practical to build an engine which will operate smoothly under the high loads encountered with high compression and (2) very material fuel economy is achieved with such engines under actual driving conditions.

How soon we will have commercial production of high compression engines depends on two factors, it is brought out. First, the rate at which the octane rating of commercial gasolines can be increased, second, how high an octane rating will be required for the satisfactory operation of a production 12 to 1 engine.

"Fortunately, this fuel-engine relationship has two sides, and the automotive engineer will be able to contribute mechanical octane numbers which are just as effective as the chemical octane numbers produced by the petroleum industry. For example, increasing the compression ratio of a certain engine by one ratio (e.g., from 7 to 1 to 8 to 1) might require that we increase the quality of our fuel by about 8 octane numbers. Therefore, if we could take the engine which now operates at 7 to 1 on a given fuel and redesign it so that it could operate at 8 to 1 on the same fuel, we would have built the equivalent of 8 chemical octane numbers into the engine. In describing this gain, we say that we have added 8 mechanical octane numbers to the engine.

"With our previous tests having already demonstrated the vast savings in fuel costs and natural resources which lie just ahead of us, we are working hard and making good headway in locating possible sources of these mechanical octane numbers. So far it appears that the most fertile field is in combustion chamber design, and our prospects along this line look very encouraging.

"Although we cannot manufacture our 12 to 1 engines this year or perhaps not even next year, we can build engines capable of utilizing the best fuel available. At the present time there are in production three engines operating at about 7.5 to 1 which may be readily modified to operate at succeedingly higher ratios until they have reached the 12 to 1 figure. It seems certain that other engines introduced in the future will follow a similar pattern, to facilitate obtaining the maximum possible benefit from the continuing technological advances of the petroleum industry."

Kettering's long-range forecast apparently discounts any effect on the trend of automotive engine development of an all-out war or a mobilization of our resources extending over some years. Experience following the last war tends to confirm his viewpoint. The technological improvements in gasoline made during the war, with the end of hostilities, were immediately applied to producing higher octane motor gasolines. Performance and superior appointments continued to be the chief factors affecting the design of the postwar cars, just as in the last prewar cars.

"Prestone" Synthetic Lube Again on the Market

COMPETITION for refiners making lube oils from petroleum is seen in the report that a "synthetic" non-petroleum motor oil is now being marketed on a wide scale in 57 cities throughout the U. S.(5)

The synthetic lubricant is being manufactured and sold by Carbide & Carbon Chemicals Corp. through its affiliate, National Carbon Co. It is promoted under the trade name "Prestone" (the same brand name used by the manufacturer for its antifreeze) and sells for $1 a quart.

At present the company is limiting sales of the synthetic for use in either new cars or cars with new or rebuilt engines. According to a Carbide and Carbon spokesman, the oil acts as a solvent to clean varnish, gum, resin and carbon deposits from an engine. Putting it into an old engine using oil, therefore, merely removes all the "gunk" from the engine and the customer finds the higher-priced oil running through faster than the oil he used before.

Primary selling feature of the Prestone oil appears to be an extended drain period. No specific crankcase drain is recommended by Carbide & Carbon except to say "change it when the oil gets dirty" and it is said that tests have shown that the oil has been used successfully for up to 100,000 miles without change.

Although the recent report on the marketing of Prestone synthetic lube doesn't indicate the nature of the material, it is probably related to the "Ucon" series of synthetic lubes which Carbide & Carbon announced back in 1946.(6) At that time the company reported that it was marketing one of the Ucon lubes "in two limited areas in the East, . . . calling the product 'Prestone' Motor Oil."

That earlier marketing effort resulted in the material being used in all types of cars—and some complaints from customers with older cars that they were using more oil than before. Carbide & Carbon quickly withdrew the oil from the market, pending further tests and development work—which apparently have renewed the company's faith in the material.

The Ucon lubes were described as being "synthesized from natural or other hydrocarbon gases as raw materials" and containing "no petroleum oils."(6)

Another report discussing the results of fleet tests with the oils identified them as "polyalkylene glycol derivatives."(7)

And just recently Harry B. McClure, vice president of Carbide & Carbon, indicated his firm's continued interest in those derivatives.(8) "In automotive service," he stated, "such compounds as the polyalkylene glycol derivatives are characterized by freedom from sludge and varnish formation under operating conditions, good low temperature starting properties, and oil consumption and wear characteristics equal to the best petroleum oils."

Although synthetic lubricants as now made are certainly more expensive than petroleum lubricants, they'll probably find a sizeable market if the motoring public can be sold on the idea that they are superior to petroleum oils. That should be particularly true if they can be used for 5000 miles or even 3000 miles as compared with the oil industry's presently recommended 1000 mile drain periods for conventional crankcase lubricants.

References

(1) "Shortages, Allocations Seen Result of GM Heavy-Duty Oil Preference", *National Petroleum News*, Dec. 13, 1950, pg. 29.

(2) American Society for Testing Materials, various news releases dated March 15, 1951, pertaining to Committee Week actions.

(3) Annual reports for 1950 of the Reserves Committees of the American Petroleum Institute and the American Gas Assn.

(4) Journal of The Franklin Institute, Vol. 251, No. 1, pg. 109 (January 1951) "Future Developments in Transportation", Charles F. Kettering.

(5) "Non-Petroleum Motor Oil Sells at $1 per Quart in Limited Marketing Test," by Holger Ridder, *National Petroleum News*, Feb. 21, 1951, p. 35.

(6) "New Synthetic Lubricants," paper by Kratzer, Green and Williams, presented before Society of Automotive Engineers, Detroit, Jan. 7-11, 1946.

(7) "Fleet Tests of Synthetic Lubricants," paper by D. K. Wilson, presented before Society of Automotive Engineers, National Transportation Meeting, Chicago, April 16-18, 1947.

(8) "Vision and Research . . ." by H. B. McClure, *Chemical and Engineering News*, Feb. 26, 1951, p. 748.

Five Santolubes to improve premium and heavy-duty oils

Added to your premium and heavy-duty lubricants, the Monsanto Santolubes, listed below, help your products deliver top performance. These Santolubes have two functions: (1) to inhibit oxidation; (2) to keep motors clean. For information write MONSANTO CHEMICAL COMPANY, Petroleum Chemicals Department, 1700 South Second Street, St. Louis 4, Missouri.

SANTOLUBE 379

Type: Detergent-dispersant-inhibitor type additive.

Typical Properties:

Specific Gravity at 60°/60° F.	0.97
Viscosity, S.U.S. at 210° F.	53
Color, ASTM (diluted)	4½
% Phosphorus	0.6
% Sulfur	5.7
% Barium	3.8

Applications: Motor-oil additive which combines the properties of detergency, dispersancy, corrosion inhibition and pour-point depression.

Literature: Technical Bulletin No. O-68

SANTOLUBE 360

Type: Detergent-dispersant-inhibitor type additive.

Typical Properties:

Specific Gravity at 60°/60° F.	0.97
Viscosity, S.U.S. at 210° F.	50
Color, ASTM (diluted)	3
% Phosphorus	0.5
% Sulfur	5.1
% Barium	4.0

Applications: A multifunctional agent, combining, in a single additive, detergency, dispersancy and corrosion inhibition. An effective pour-point depressant.

Literature: Technical Bulletin No. O-66.

SANTOLUBE 388

Type: Detergent-dispersant-inhibitor type additive.

Typical Properties:

Specific Gravity at 60°/60° F.	1.00
Viscosity S.U.S. at 210° F.	55
Color ASTM (diluted)	5
% Phosphorus	.5
% Sulfur	5.4
% Barium	6.1

Applications: Heavy-duty oil additive. Suitable for meeting current military specifications.

SANTOLUBE 374

Type: Detergent-dispersant-inhibitor type additive

Typical Properties:

Specific Gravity at 60°/60° F.	0.98
Viscosity, S.U.S. at 210° F.	50
Color, ASTM (diluted)	5
% Phosphorus	0.8
% Sulfur	6.6
% Barium	3.6

Applications: A single motor-oil additive that combines detergency, dispersancy, corrosion inhibition and pour-point depression.

Literature: Technical Bulletin No. O-67

SANTOLUBE 395X

Type: Antioxidant and bearing-corrosion inhibitor.

Typical Properties:

Specific Gravity at 60°/60° F.	1.01
Viscosity S.U.S. at 210° F.	75
Color ASTM (diluted)	4
% Phosphorus	3.8
% Sulfur	10.5
% Barium	1.1

Applications: Recommended for compounding premium-type motor oils.

Literature: Technical Bulletin No. O-56.

MONSANTO PETROLEUM ADDITIVES

Pour-point depressants
SANTOPOUR*
SANTOPOUR B
SANTOPOUR C

Motor-oil inhibitors
SANTOLUBE* 395-X, 394-C

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SANTODEX*

Gear-lubricant additives to meet requirements of Federal specification VV-L-761
SANTOPOID* S, S-R1

Gear-lubricant additives to meet requirements of military specification MIL-L-2105
SANTOPOID 29, 32, 33

Motor-oil detergents
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Corrosion inhibitor for distillate fuels
SANTOLENE* C

Sludge inhibitor for domestic fuel oils
SANTOLENE E

Cutting-oil additive
SANTOLUBE 52

Inhibitor-detergent combinations for premium and heavy-duty service
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By providing more surface area in the same tube length, Wolverine Trufin* condenser tubes help to conserve tubing. You use less compared to plain surface condenser tubes.

The increased surface area of Wolverine Trufin also permits more economy in producing most petroleum condensates.

With the fins integral with tube itself Trufin condenser tubes can withstand vibration, they can be easily cleaned and the tube lasts longer. Retubing and "shut down" time is reduced appreciably.

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LETTERS

Stabilized Steels

. . . With the current shortage of the stabilized grades of 18-8 stainless steels, I feel quite certain that the balance of the refining industry will quickly learn that Mr. Holmberg is wholly correct ["High Temperature Service with Austenitic Steels," March, p. 256]; that is, stabilizers are not required in 99.9% of the refinery applications of the austenitic heat resisting alloys. If anything, I believe I have a more decided opinion to this effect than Mr. Holmberg does.

"Stabilizers" may be effective for relatively short times but I don't believe they can be depended upon to "stabilize" for the length of time at sensitizing temperatures (750 to 1600° F.) frequently encountered in refinery service. I have seen several cases where so-called stabilized 18-8 Cb Type 347 failed due to intergranular corrosion. (As Mr. Holmberg reports, the intergranular attack occurred during shut down when the equipment was cold so that aqueous water could exist.)

Again, the so-called stabilized 18-8 alloys are frequently poorer engineering materials than the corresponding alloys which have normal carbon contents and which are free of titanium and columbium. The non-stabilized alloys have a better chance of being single phase materials (free of ferrite and sigma), in addition to being freer of "dirt" and inclusions, as Mr. Holmberg points out.

It is high time that the users of the austenitic stainless steels realize that they may be spending money foolishly when purchasing the so-called stabilized alloys—they should be deeply thankful to Mr. Holmberg. Again, they should be always aware of the mechanical difficulties they may encounter due to the combination of high expansion and low thermal conductivity of these austenitic heat resistant materials, which Mr. Holmberg so clearly explains.

KARL LUGER

K. E. Luger Co.
Houston, Texas

Cleaner Exchangers

. . . It seems to the writer that this subject ["Three Ways to Clean Exchangers," Feb., p. 150] is of paramount importance. I am wondering how many millions of dollars worth of heat is wasted annually through the accumulation of dirt and scale on tubing which is not removed promptly and regularly. Your efforts to publicize this condition should result in conservation of fuel and thus help our defense program.

PHILIP DAVIDSON
Advertising Manager
Bridgeport Brass Co.
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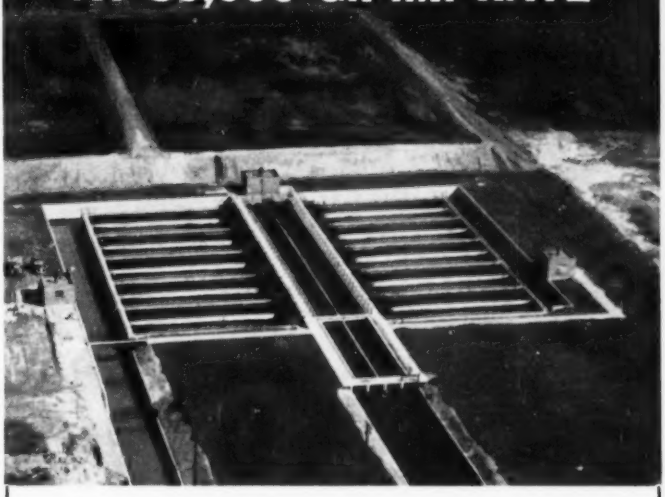
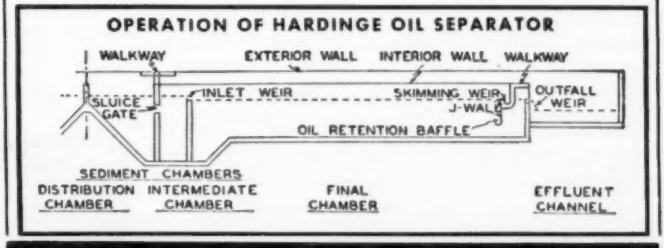
OIL-WATER SEPARATED AT 80,000 G.P.M. RATE



11 HARDINGE RECTANGULAR CLARIFIERS RECLAIM OIL AT OHIO REFINERY

Reclamation of oil from refinery water and clarification of water before discharge into streams is being accomplished by Hardinge Rectangular Clarifiers in refineries throughout the country. Hardinge will show you how this job can be profitably handled at your plant from their file of successful installations. Write us today, of your problem.



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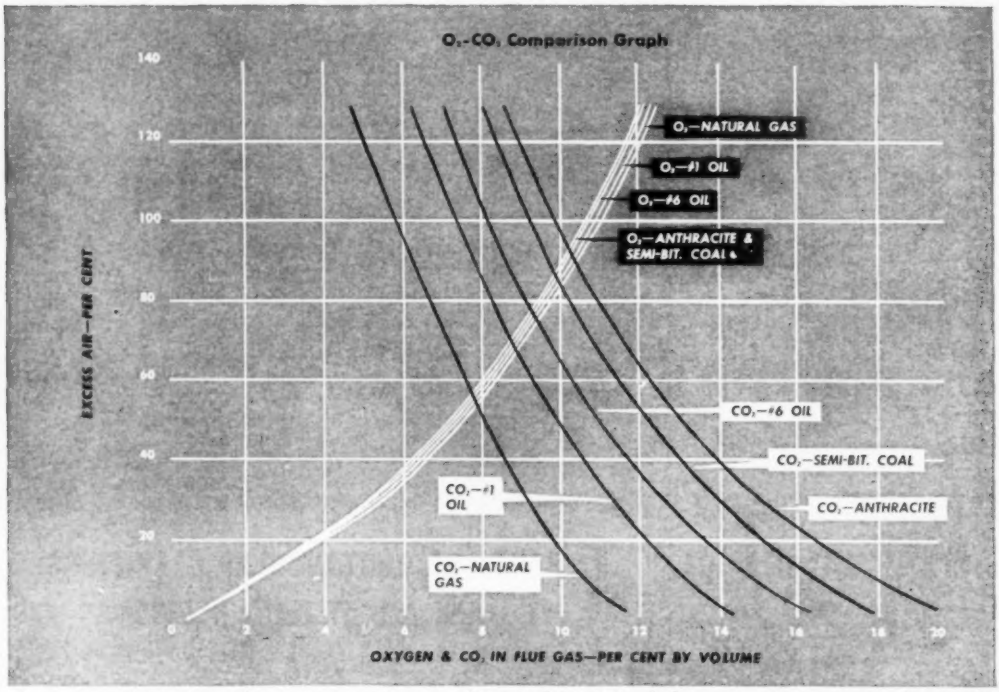
How to burn Multiple Fuels efficiently



Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

When switching from one fuel to another or burning more than one fuel at the same time, you can realize large savings with a continuous indication of Oxygen content in your flue gas—because Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

This fact is borne out by the graph showing the relationship of excess air to CO_2 and O_2 in the flue gas of five common fuels. While the O_2 curves nearly coincide (especially in the important 30% excess air range) the CO_2 curves diverge widely.

Large Savings Possible

This deviation was costing a medium sized refinery in Michigan $35-40 per day in boiler room fuel costs. Burning a combination of oil and gas they found that a combustion control system to handle their multiple fuel firing conditions would cost more than their small boilers.

They purchased a Hays Magno-Therm Oxygen Recorder, and immediately found that their boiler operation was so inefficient that the pen would not stay on the 0-10% chart. However, by operating with reference to the O_2 recorder they were able to reduce fuel costs enough *to pay for the instrument in 40 days.*

With the Hays Magno-Therm Oxygen Recorder you get:

Continuous, highly accurate indication and recording.
Complete compensation for temperature and pressure effects.
Freedom from chemicals or hazardous fuel burning in the analyzing process.
Swift, sure electronic operation.

If you are facing the problem of multiple fuel combustion, you will want a detailed copy of this O_2-CO_2 Comparison Graph as well as Hays Bulletin 50-829—describing the Magno-Therm Oxygen Recorder. Write for this free information.

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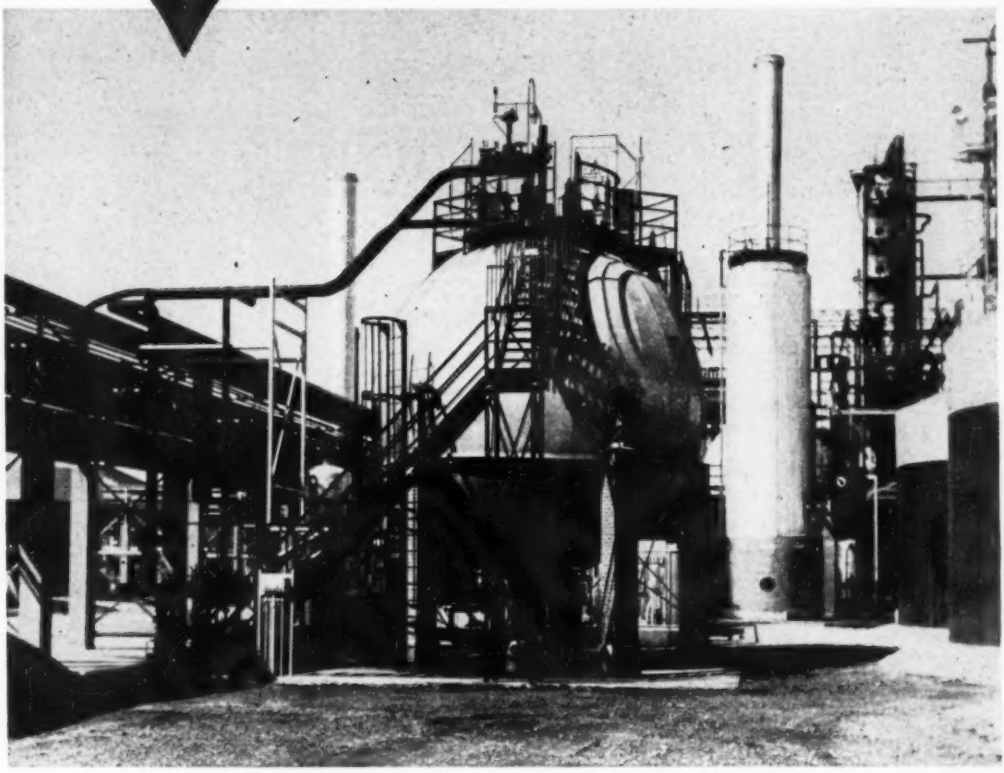
CONOCO *another leading refiner who desalts with PETRECO*



CONTINENTAL OIL COMPANY is now using Petreco Desalting in four different refineries,—New Mexico, Oklahoma, Texas and Louisiana. Four successive installations by a refining organization with Conoco's established reputation is ample evidence that Petreco Desalting proved itself once for Conoco, and has continued to do so with each successive installation. If you want the best in salt removal performance, specify Petreco and be assured of

Minimum Residual Salts and Solids
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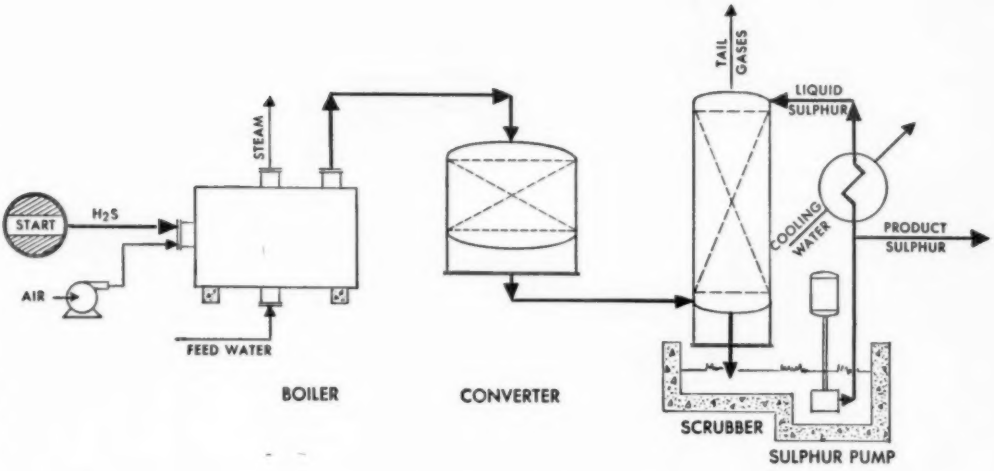
SULPHUR...

Girdler plant produces it from hydrogen sulphide



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HYDROGEN SULPHIDE, which is easily removed from sour refinery gas, natural gas, or liquid hydrocarbons, using the Girbotol process, can be converted into elemental sulphur by a Girdler Sulphur Plant.

One man can operate the average Girdler installation. Operation is continuous, practically automatic, instrument-controlled. Up to 95% of the sulphur present can be recovered with a two-stage plant. A single-stage plant, which is less costly, recovers up to 85% of the sulphur.

If you are considering a purification and sulphur plant write The Girdler Corporation, Gas Processes Division, Louisville 1, Kentucky.

SULPHUR IS SCARCE!
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• If you remove hydrogen sulphide from gaseous or liquid hydrocarbons, you should consider converting it into a valuable by-product. The acid gas stream from a Girbotol purification plant is usually an ideal feed material for sulphur production.

THE GIRDLER CORPORATION
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NEW REFRACTORY DOES THE "IMPOSSIBLE"

Unusual properties of NORTON FUSED STABILIZED ZIRCONIA start new processing era

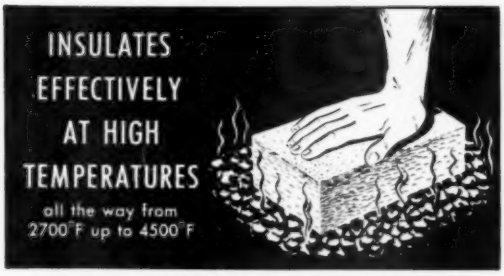
AGAIN . . . Norton Research opens the doors to new technical advances in the processing field. First to produce Fused Stabilized Zirconia in commercially significant quantities, Norton now makes it possible for you to lift your process-temperature ceiling up to 4500°F.

Extraordinary properties

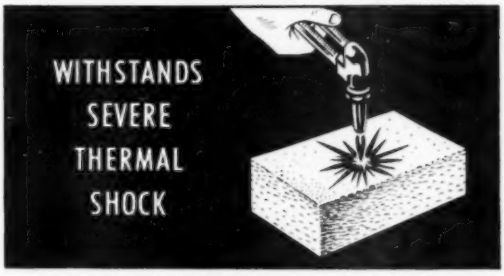
No other refractory offers such an unusual combination of properties. *Resistance to high temperature* comes first, of course. But look at its *low thermal conductivity* . . . surprising because of its relatively heavy weight (twice fire clay's). What's more, Norton Stabilized Zirconia insulating grain has a thermal conductivity of only 3 Btu. Consider, too, its *great strength* at elevated temperatures . . . its ability to *resist oxidizing and reducing atmospheres at high temperatures* . . . its *chemical inertness* in contact with titanates. Even more amazing is the *electrical resistivity* of Norton Fused Stabilized Zirconia . . . ranging from 2300 ohm-cm. at 1300°F down to 0.37 ohm-cm. at 4000°F. Resistance furnace operators take notice.

WRITE FOR DATA. In Technical Bulletin SZ1, Norton researchers and refractory engineers give you all the up-to-the-minute facts about Fused Stabilized Zirconia. Get your copy . . . use the coupon below today.

HIGHLY REFRACTORY, Norton Stabilized Zirconia has successfully speeded up gas synthesis production by permitting operating temperatures as high as 4500°F. Resists *all* oxidizing atmospheres and *most* reducing atmospheres.



LOW THERMAL CONDUCTIVITY of Norton Stabilized Zirconia brick of 6 Btu compares well with 3000°F insulating brick's 6+, fire clay's 12, alumina's 20 and silicon carbide's 50+ (approximate values at 2700°F).



GOOD THERMAL SHOCK RESISTANCE of Norton Stabilized Zirconia to extreme temperature gradients and rapid thermal changes offers interesting new possibilities in all processing industries where high temperature is a factor.

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Gentlemen:
Please send me without obligation, Technical Bulletin SZ1 on Norton Fused Stabilized Zirconia. I'm interested in investigating its use for:

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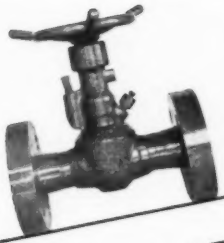


FORGED STEEL PRODUCTION VALVES L. P. GAS VALVES

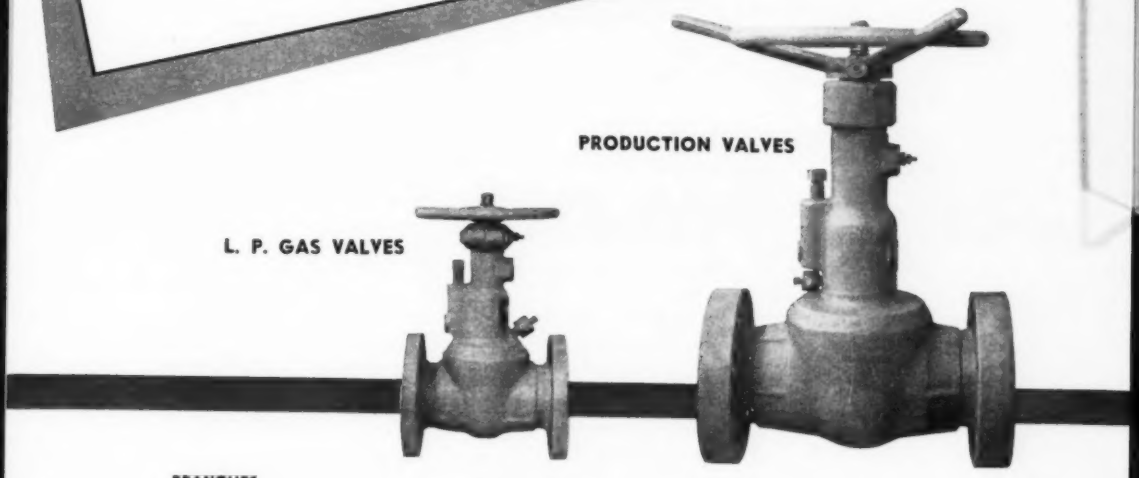
ORBIT FORGED STEEL VALVES have set new standards of efficiency, simplicity and compactness in valve design. The Orbit Friction Free Seating Principle requires no lubrication of the sealing surfaces to effect a positive shutoff.

After installation ORBIT FORGED STEEL VALVES require infrequent attention because only nominal amounts of lubricant is required for the Stem mechanism.

ADJUSTABLE PLASTIC STEM PACKING is employed which is effective and permanent. This packing will seldom, if ever, need adjusting after the valve goes into service.

PRODUCTION VALVES

L. P. GAS VALVES



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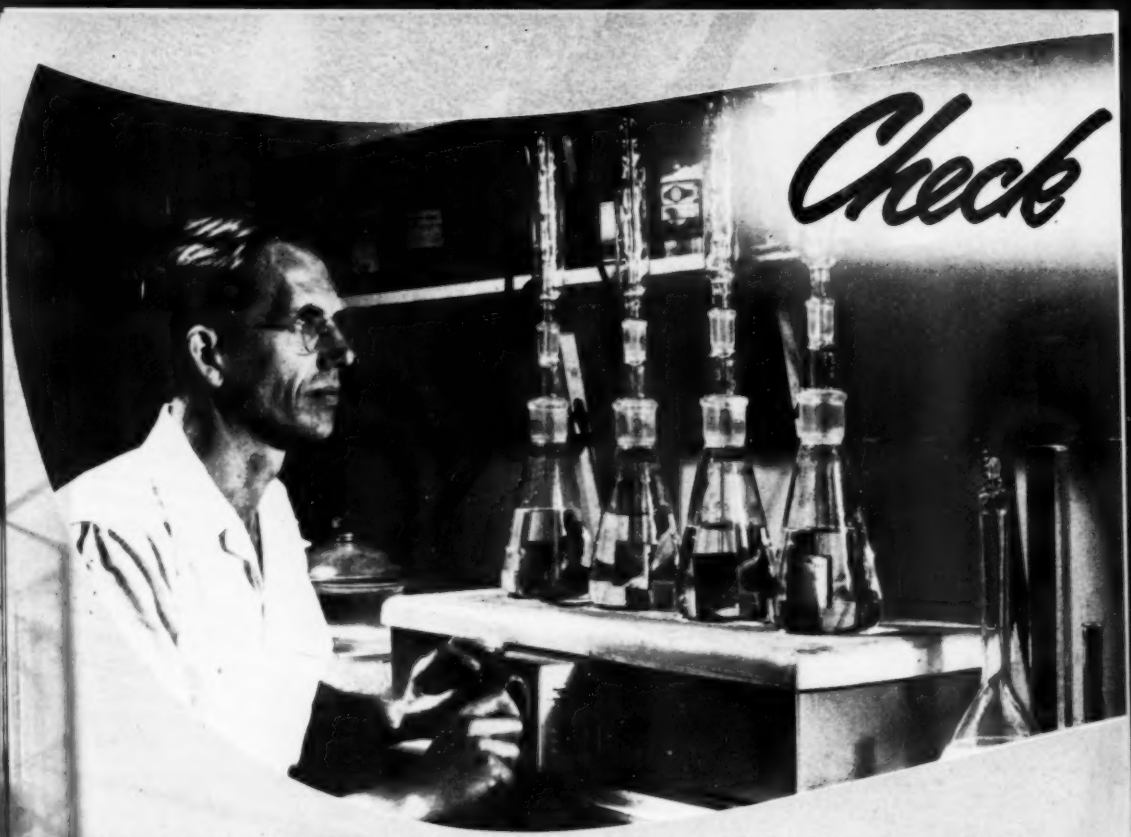
CASPER, WYOMING
The Great Western Company
(serving the Rocky Mountains and Canada)

Your Supply Store Carries Orbit Valves in Stock

ORBIT VALVE COMPANY

P. O. BOX 699 TULSA, OKLAHOMA



Typical Applications in which Ampco Alloys have been used with Cost-Saving Success!

- Absorption columns
- Acetylators
- Acid chain
- Agitators
- Autoclaves
- Baskets
- Bearings
- Beater bars
- Bellows
- Bolts and nuts
- Brazing rod
- Brine coils
- Bubble caps and trays
- Calandrias
- Condenser shells
- Condenser tubes
- Condenser tube sheets
- Control valves
- Conveyors
- Coolers
- Crystallizers
- Dephlegmators
- Digesters
- Ejectors
- Evaporators
- Evaporator tubes
- Extractors
- Fabricated assemblies
- Filters and filter screens
- Filter presses
- Fittings — forged, cast
- Forgings
- Fractionating columns
- Hangers
- Heat exchangers
- Heater coils
- Hooks
- Injectors
- Instrument cases and elements
- Kettles
- Line hardware
- Meter cases
- Mixers
- Pans, evaporator
- Perforated plate
- Pickling baskets
- Pipe and fittings
- Plug cocks
- Pressure vessels
- Pumps
- Reboilers
- Retorts
- Rivets
- Safety tools
- Screens
- Screws, conveyor
- Sludge burners
- Springs
- Stills
- Studs
- Sucker rod
- Tanks
- Tools, safety
- Towers
- Trays, fractionating
- Tubes and tubing
- Vats
- Valves
- Welding rod
- Well tubing
- Wire
- Woven wire cloth

Chemical Agents and the Applicability of AMPCO Alloys

Acetate Solvents (Pure)	E
Crude	G
Acetic Acid	
Crude	E
Vapors	E
Acetic Anhydride	G
Acetone	E
Acetylene	NR
Alcohols	E
Aluminum Fluoride	G
Aluminum Sulfate	G
Aluminum Hydroxide	E
Ammonia Gas	
Dry	G
Wet	NR
Ammonium Chloride	NR
Ammonium Hydroxide	NR
Ammonium Nitrate	F
Ammonium Phosphate	F
Ammonium Sulfate	F
Amyl Chloride	E
Asphalt	E
Barium Chloride	G
Beer	E
Beet Sugar Liquors	E
Benzene or Benzol	E
Borax	E
Boric Acid	E
Brine	E
Butane, Butylene	E
Butadiene	E
Butyric Acid	E
Calcium Bisulfite	G
Calcium Hydroxide	G
Calcium Hypochlorite	F
Cane Sugar Liquors	E
Carbolic Acid	E
Carbon Dioxide	
Dry	E
Wet	G
Carbon Disulfide	F
Carbon Tetrachloride	E
Caustic Soda	E
Chlorine	
Dry	G
Wet	NR
Chloroform	E
Chromic Acid	NR
Citric Acid	E
Copper Sulfate	NR
Crude Oils — Sour	G
Esters	E
Ethers	E
Ethylene Glycol	E
Ethyl Sulfate	E
Ferric Chloride	NR
Ferric Sulfate	NR
Formaldehyde	E
Formic Acid	E
Freon	E
Furfural	E
Gasoline	E
Gelatine	E
Glucose	E
Glycerine	E
Hydrocarbon Gases	E
Hydrochloric Acid	
to 5%	G
to 10%	F
(see Muriatic)	
Hydrocyanic Acid	NR
Hydrofluoric Acid	G
Hydrogen Fluoride (Dry)	E
Hydrogen	E
Hydrogen Peroxide	F
Hydrogen Sulfide	
Wet	NR
Dry	F
Lacquers and Lacquer Solvents	E
Lactic Acid	E
Magnesium Chloride	G
Magnesium Hydroxide	E
Magnesium Sulfate	E
Malt Beverages	E
Mercuric Chloride	NR
Mine Water (Sulfate)	E
Molasses	E
Monochlorobenzene	E
Muriatic — Cold, Commercial	G
Naptha	E
Natural Gas	E
Nickel Chloride	F
Nickel Sulfate	G
Nitric Acid	NR
Nitrogen (Dry)	E
Oleic Acid	E
Oxygen	E
Paint Vehicles (Except Soya-Oil)	G
Palmitic Acid	E
Petroleum Oils	
Sour	G
Refined	G
Phenol	E
Phosphoric Acid	E
Pickling Acid (except Nitric Chromic)	E
Potassium Chloride	E
Potassium Cyanide	NR
Potassium Hydroxide	F
Potassium Sulfate	E
Potash Crudes	E
Propane	E
Shellac	E
Soaps	E
Soda Ash (Sodium Carbonate)	G
Sodium Bicarbonate	E
Sodium Bisulfate	E
Sodium Carbonate	E
Sodium Chloride	E
Sodium Cyanide	NR
Sodium Hydroxide	E
Sodium Nitrate	G
Sodium Perborate	E
Sodium Peroxide	F
Sodium Phosphate	
Alkaline	E
Neutral	E
Acid	G
Sodium Silicate	E
Sodium Sulfate	
(Soda Cake)	E
Sodium Sulfide	NR
Sulfur	F
Sulfur Chloride	NR
Sulfur Dioxide	
Dry	G
Wet	G
Sulfuric Acid	
5%)	E
10%)	E
25%) Up to Boiling	E
35%)	E
50%)	E
Sulfuric Acid Sludge	E
Sulfurous Acid	G
Tannic Acid	G
Tartaric Acid	E
Toluene or Toluol	E
Tri Chlorethylene	E
Tri Sodium Phosphate	E
Turpentine	E
Varnish	E
Vegetable Oils	E
Water	
Fresh	E
Salt (includes Polluted Harbor)	E
Xylene	E
Zinc Chloride	G
Zinc Sulfate	E

These ratings may usually be interpreted as follows:

E — Excellent
IPY Penetration
< 0.006"

G — Good
IPY Penetration
< 0.015"

F — Fair
IPY Penetration
< 0.050"

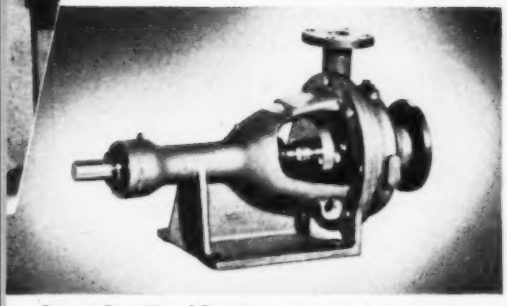
NR — Not Recommended
IPY Penetration
Over 0.050"

In using this data, it should be understood that these are results of specific tests and are indicative of those conditions under which the tests were run, and are a basis for recommendation, but not for guarantee.

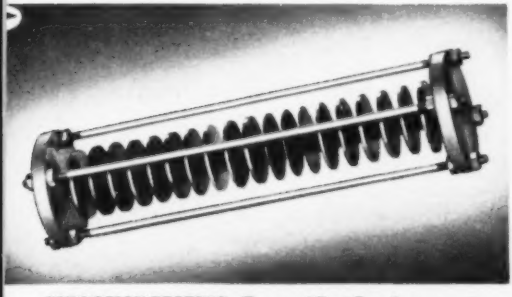
AMPCO

Your Corrosion Problems ...use Ampco Alloys

...these unique properties have proved to be the best answer to many process equipment problems



Ampco Centrifugal Pumps —Here—for the first time in pump manufacturing history — is a "production-built" and "production-priced" pump to handle acids, alkalies, and other corrosive agents hitherto requiring specially built pumps. The Ampco single-stage, single-suction centrifugal pump offers long life, high efficiency and low maintenance costs through the combination of correct design and properly selected materials.



CORROSION TESTING—Types of Test Specimens — A complete stock of test specimens of a wide variety of materials is kept ready for mounting on racks. Several forms of racks are available for tests in atmospheric locations, pipe lines, tanks or other pressure vessels. When requesting test specimens please outline conditions under which test is to be conducted so that we may supply the most suitable form.

1. High resistance to corrosion
2. High tensile strength
3. High physicals at extreme temperatures
4. High strength to weight ratio
5. High impact and fatigue values
6. High wear-resistance — to erosion — corrosion — cavitation, etc.
7. High compressive strength
8. High modulus of elasticity

Designers and plant engineers in the process industries are turning to Ampco Alloys more and more frequently — because of the outstanding savings offered by their long-lasting qualities.

Costs are reduced in three ways: 1. Minimum down time, 2. Minimum product loss from parts failure, and 3. Minimum maintenance and replacement expense.

Study the list of time-proven applications and the Ampco applicability chart and apply this data to your own needs. Plan your own economies now by specifying Ampco Bronze Alloys for corrosive and erosive media handling. Write today for recommendations and complete information.

★ ★ ★

Ampco aluminum bronzes are available in a number of grades to meet your exact requirements in any form you need: rolled sheet or plate, sand or centrifugal castings, forgings or extrusions . . . pipe and fittings. Also, Ampco's arc-welding electrodes, corrosion-resistant centrifugal pumps and plug valves.

Free . . .
Process Industries Bulletin — 16 pages of money-saving information.

AMPCO

Ampco Metal, Inc.
Milwaukee 46, Wisconsin
West Coast Plant *Burbank, California*

Ampco Metal, Inc., Dept. PP-4, Milwaukee 46, Wis.

Send me your free bulletin, giving full information on the application of Ampco Alloys in the Process Industries.

Name ..... Title .....

Company .....

Company Address .....

City ..... ( ) State .....

RECENT REFINERY VESSELS FROM GRAVER SHOPS

These pictures show the significant part Graver is taking in the modernization and expansion of the nation's refinery facilities.

1. Two sections of a Separator Surge Tank, 14′0″ x 35′2″
2. Part of a Catalyst Airlift
3. Fines and Fresh Catalyst Storage Bin, 12′0″ x 48′3″
4. Houdry Process Vessel of molybdenum steel, 12′0″ x 50′0″
5. Desalting Tank, 12′0″ x 40′0″
6. Refinery Tower, 7′0″ x 102′11″

These fabrications are exhibits of Graver versatility and indicate the extent of Graver Services to the petroleum industry.

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

NEW YORK • CHICAGO • PHILADELPHIA • WASHINGTON
DETROIT • CINCINNATI • CATASAUQUA, PA.
HOUSTON • SAND SPRINGS, OKLA.

(To obtain more data on advertised products see page 432)

Think of this sign first . . . . . .

for **Ethylene**

Manufacturing Facilities

The Lummus reputation for keeping its sights leveled at highly practical objectives is of particular value in the designing and constructing of ethylene manufacturing facilities. The very stature of ethylene—most important of hydrocarbon raw materials for petroleum chemical synthesis—should make such a point of view attractive to industry.

First, Lummus places emphasis on processing for higher yields and lower costs. Detailed processing and engineering studies dictate the scheme to be employed for specific operations. The company's fund of knowledge covering all commercially-applied techniques for making ethylene carries on from there. Lummus' pilot plant and development work have produced important tools to achieve maximum performance and flexibility. Special Lummus cracking heaters meet specific requirements for converting ethane, propane, or mixtures of both to an ethylene-rich effluent.

Second, Lummus places emphasis on the design of ethylene units for lower initial outlay, thus increasing the refiner's profit margin and diversity of income. This is extended to include recognition of metals-availability in the period ahead, as well as planning for rock-bottom maintenance and upkeep costs.

Third, Lummus recognizes the special responsibility of handling confidential information in accordance with the best interests and desires of the customer.

We invite you to think of Lummus first in *your* plans for petroleum chemical expansion.

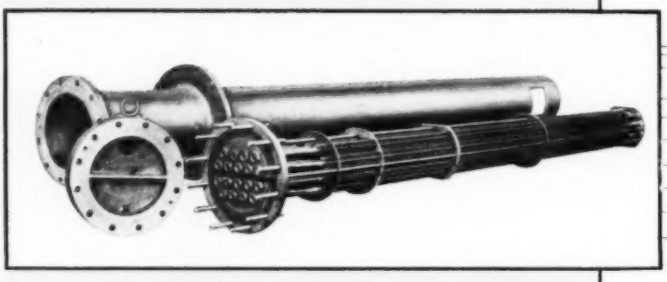
THE LUMMUS COMPANY

385 MADISON AVENUE, NEW YORK 17, N. Y.

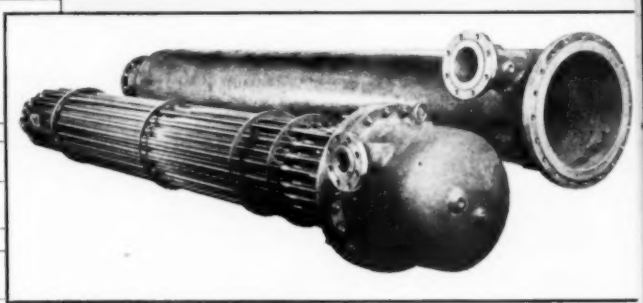
CHICAGO • HOUSTON • LONDON • CARACAS • PARIS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

Why G-FIN..... for



Design for heater installed partly within tank



Design for heater installed outside of tank

GRISCOM-RUSSELL: PIONEERS IN HEAT TRANSFER APPARATUS

Storage Tank Oil Heating

Here is the most practical unit for heating oil to be withdrawn from storage tanks.

The effectiveness, compactness, dependability and ease of inspection and maintenance of the G-Fin Storage Tank Oil Heater have made it widely used for every type and grade of viscous oil.

Some of the outstanding features of this heater are briefly outlined in the column at the right. These features are based on the unequalled G-R experience of more than 80 years in the design, manufacture, and operating results of many hundreds of thousands of heat transfer units. When you buy a G-Fin Storage Tank Oil Heater, you get authoritative ratings, skillful design which is exclusive in many respects, sturdy construction with accurate machine work, and proven performance.

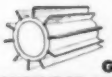
Write for bulletin describing these units in detail.

THE GRISCOM-RUSSELL CO.

285 MADISON AVE., NEW YORK 17, N. Y.

GRISCOM-RUSSELL

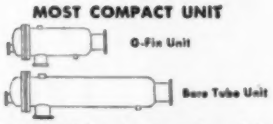
G-FIN STORAGE TANK OIL HEATER FEATURES



G-FIN EXTENDED HEATING SURFACE

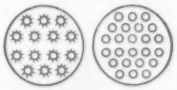
The G-Fin elements have eight times more heating surface than bare tubes of the same cross-sectional area and length.

MOST COMPACT UNIT



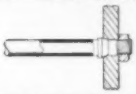
The increased heat transfer surface of the G-Fins means more heating surface in a given volume, and thus least heater space for a required duty.

FEWER TUBE JOINTS



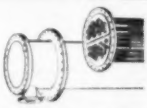
The small number of G-Fin heating elements results in a minimum of tube joints.

LEAKPROOF JOINTS



The conical ends of the G-Fin elements are seated in the tube sheet with accurately machined metal-to-metal joints held tight by lock-nuts.

ACCESSIBILITY FOR CLEANING



By removing lock-nuts at the tube sheet, individual G-Fin elements can be removed from the heater for inspection, thorough cleaning or replacement.

GR-261

GRISCOM-RUSSELL: PIONEERS IN HEAT TRANSFER APPARATUS

It's time we got *working* mad!

As we listen to the latest insults from Moscow, we're likely to get fighting mad.

Instead, we'd better use our heads and get *working* mad.

It is clear by now that Stalin and his gang respect just one thing—strength. Behind the Iron Curtain they've been building a huge fighting machine while we were reducing ours. Now we must rebuild our defenses—*fast.*

As things stand today, there is just *one* way to prevent World War III. That is to re-arm—to become strong—and to stay that way!

This calls for better productivity all along the line. Not just in making guns, tanks and planes, but in turning out civilian goods, too.

Arms must come first. But we must produce arms *at the same time* we produce civilian goods.

We can do this double job if we all work together to turn out more for every hour we work—if we use our ingenuity to step up productivity.

All of us must now make sacrifices for the common good. But we're working for the biggest reward of all —*peace with freedom!*

THE BETTER WE PRODUCE THE STRONGER WE GROW

A PUBLIC SERVICE PROJECT · THE ADVERTISING COUNCIL

FOR A FREE COPY OF "THE MIRACLE OF AMERICA"

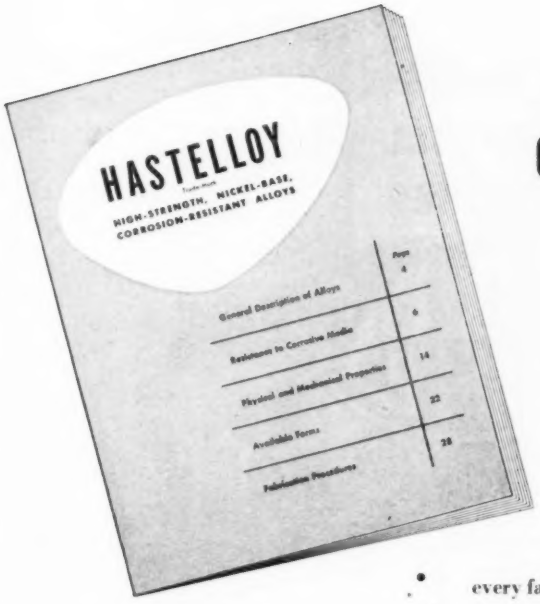
MAIL THE COUPON to Public Policy Committee, The Advertising Council, Inc., Dept. B.P., 25 West 45th Street, New York 19, N. Y.

Name .....

Address .....

.....

PETROLEUM PROCESSING



Get the latest data on 4 ALLOYS to combat severe corrosion

Every designer . . . every engineer . . . and every fabricator who is faced with the problem of selecting a high-strength material that will withstand severe chemical corrosion should have a copy of this new 40-page booklet. It tells the story of the four HASTELLOY alloys—what they are, how they are fabricated, and how they can be used to combat severe corrosion.

HASTELLOY alloys are being used successfully in every branch of the chemical and allied industries . . . in the production of chemicals, petroleum, textiles, plastics, aircraft, and metals. To get the latest data on these versatile materials of construction, just fill out the handy coupon below for your free copy of the booklet, "HASTELLOY High-Strength, Nickel-Base, Corrosion-Resistant Alloys."

The trade-marks "Haynes" and "Hastelloy" distinguish products of Union Carbide and Carbon Corporation.

HERE'S WHAT'S IN IT

Description of the HASTELLOY Alloys—A brief summary of the chemical composition and physical properties of the four alloys: A, B, C, and D.

Resistance to Corrosion—Easy-to-read tables show the resistance of each of the HASTELLOY alloys to 8 common corrosive media.

Physical and Mechanical Properties—Four pages of tables give properties at room temperature and also at elevated and sub-zero temperatures. Graphs compare the properties of HASTELLOY alloys with those of other metals.

Available Forms—HASTELLOY alloys can be supplied as conventional and precision investment castings; hot-rolled bar stock, sheet, and plate; wire, tubing, and welding rod; also, pipe and fittings.

Fabricating Procedures—The proper procedures for welding, heat-treating, hot-working, cold-working, surface preparation, machining, and grinding the alloys are given.

HAYNES Trade-Mark *Alloys*

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC

USE THIS HANDY COUPON

Haynes Stellite Company, 725 So. Lindsay Street, Kokomo, Indiana

Please send me the new edition of your booklet, "HASTELLOY High-Strength, Nickel-Base, Corrosion-Resistant Alloys."

NAME_____

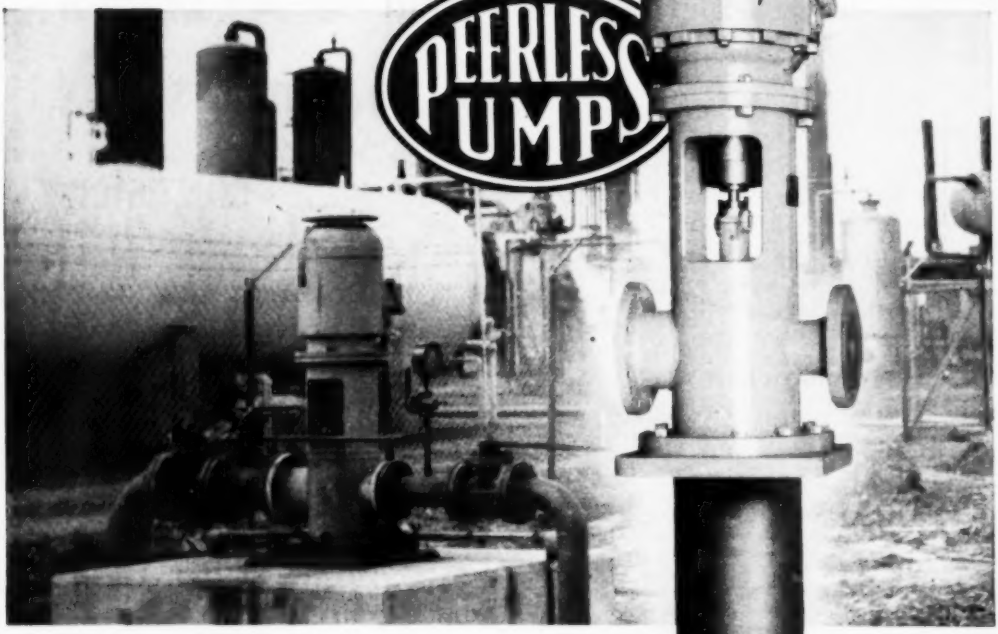
COMPANY_____

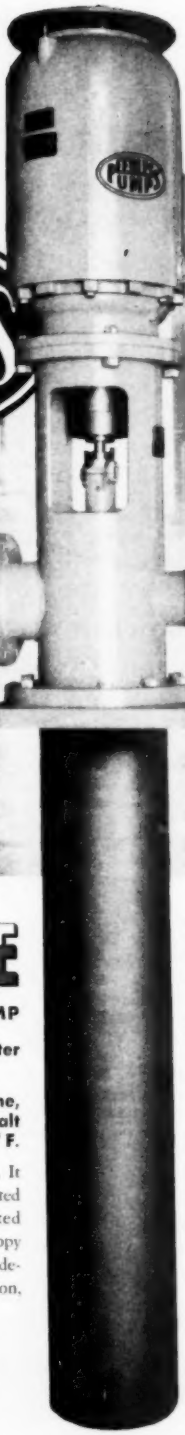
ADDRESS_____

(To obtain more data on advertised products see page 432)

FOR LIMITED NPSH APPLICATIONS IN ALL INDUSTRIAL PROCESSES

...AND FOR INSTALLATIONS WHERE FLOOR SPACE IS AT A PREMIUM





THE *Peerless* HYDRO-LINE

ENCASED CLOSE-COUPLED VERTICAL CENTRIFUGAL PUMP

For application to: **Petroleum Refinery Techniques • Line Booster Service • Chemical Processing • Condensate Return Service.**

Especially suited for Pumping: **Hydrocarbons, such as: Gasoline, Propane, Butane, Oils, etc. • Hot or Cold Water • Acids • Bases • Salt Solutions—Mild or concentrated at temperatures from normal to 400° F.**

This successful modification of the Peerless vertical, close-coupled turbine pump, for industrial processes embodies all the exacting design, construction and performance characteristics which have made Peerless the sales leader in the field of vertical turbine pumps. The Peerless Hydro-Line is easy to understand, install, operate and maintain. It has been especially designed for limited space requirements and for limited NPSH applications. Request your copy of Peerless Bulletin B-592 for full details of Hydro-Line design, construction, application and performance.

CHARACTERISTICS AT A GLANCE:

CAPACITIES
Up to 5000 GPM.

HEADS
Up to 1500 feet.

DRIVES
As required; standard vertical, solid shaft, hollow-shaft, or explosion-proof motors; steam turbine.

MATERIALS
Cast iron bowls, bronze impellers, #416 stainless steel shaft, standard; any special materials can be furnished on order to suit the individual need.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION

Address Inquiries to Factories at:
Los Angeles 31, California or Indianapolis 8, Indiana.
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview, Lubbock, Texas; Albuquerque, New Mexico.

(To obtain more data on advertised products see page 432)

It is significant that as Canada's petroleum industry expands, more and more Petro-Chem Iso-Flow Furnaces are called upon to meet the increasing requirements of oil refineries, pipe lines, gas plants and allied chemical industries...in Canada, as throughout the world, Petro-Chem Iso-Flow Furnaces are demonstrating the unique and superior features inherent in their design.

There is a Petro-Chem Iso-Flow Furnace for every process requirement irrespective of size, capacity or duty. More than 750 are now in satisfactory operation throughout the world.

PETR CHEM
ISO-FLOW FURNACES
UNLIMITED IN SIZE . . . CAPACITY . . . DUTY
PETRO-CHEM DEVELOPMENT CO., INCORPORATED
120 EAST 41ST STREET, NEW YORK 17, N. Y.
Representatives: Bethlehem Supply, Tulsa and Houston - Flagg, Brackett & Durgin, Boston - D. D. Foster, Pittsburgh - Faville-Levally, Chicago - Lester Oberholz, California

(To obtain more data on advertised products see page 432)

Sun Oil, Toledo, goes on stream with first big Houdriflow units...

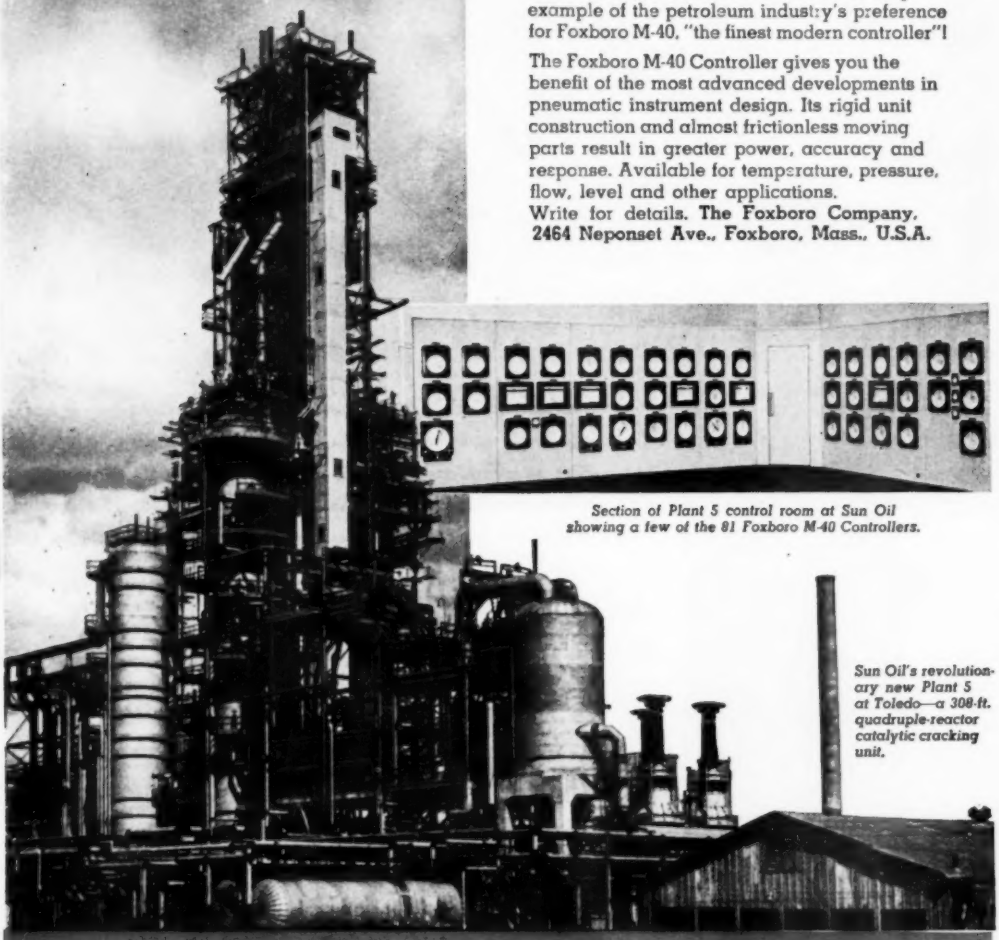
... under Foxboro M-40 Control

When Sun Oil Company's new Plant 5 at Toledo, Ohio, went on stream last May, 81 Model 40 Controllers took over critical control functions. Without any manual "juggling", process variables came directly to their control points, because M-40 met the preset values so exactly. And the inherent accuracy of the M-40 *held* them there, continuously!

This first major installation of Houdriflow "cat" crackers offers another outstanding example of the petroleum industry's preference for Foxboro M-40, "the finest modern controller"!

The Foxboro M-40 Controller gives you the benefit of the most advanced developments in pneumatic instrument design. Its rigid unit construction and almost frictionless moving parts result in greater power, accuracy and response. Available for temperature, pressure, flow, level and other applications.
Write for details. **The Foxboro Company, 2464 Neponset Ave., Foxboro, Mass., U.S.A.**

Section of Plant 5 control room at Sun Oil showing a few of the 81 Foxboro M-40 Controllers.



Sun Oil's revolutionary new Plant 5 at Toledo—a 308-ft. quadruple-reactor catalytic cracking unit.

FOXBORO REG. U. S. PAT. OFF. **CONTROLLERS**

PETROLEUM CHEMICALS DIVISION

NEWS

April ★ One of a Series of Interest to the Petroleum Industry ★ 1951

Du Pont Antioxidant No. 5 Put to Unusual Use by Steel Company

The Kaiser Steel Corporation at Fontana, California has put Du Pont Gasoline Antioxidant No. 5 to an unusual use. This was done in their by-products coke department carbon disulphide tower, which runs secondary light oil from the coking unit.

Previous to the use of Antioxidant No. 5, the tower was shut down periodically about every 3 months for a clean-out because of increased back pressure resulting from a flaky residue in the trays. The first operational run after the Du Pont additive was used lasted 13 months before a shut-down was necessary.

Costwise, the antioxidant addition more or less balanced the direct cost of the more frequent shut-downs. But the inconvenience and the indirect costs of the interrupted operation more than tipped the scales in favor of the inhibitor.

Du Pont Explosives and Know-how Help Locate Oil Deposits

As petroleum men know, wildcatting for oil in an unproved area is no longer as wild a gamble as it used to be. Where once the driller depended chiefly on surface indications and a general knowledge of the local geology, he now seldom starts until he has seen an underground "map" of the area.

Here a seismic shot has just been fired. The explosive used was Du Pont's "Nitramon" S.

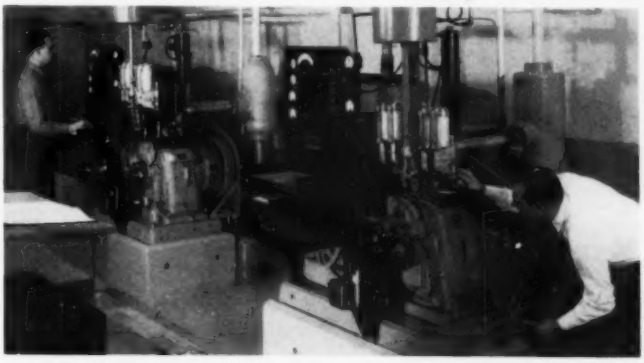
With such a "map" he has a good chance of knowing where salt domes, anticlines, rock faults, limestone reefs and other formations likely to "trap" oil are located.

These sub-surface pictures are made possible through geophysical methods of prospecting, the most widely used of which is seismic prospecting. Charges of explosives, averaging about 15 pounds in weight, are loaded into specially drilled shot holes in the ground. When these are fired, shock waves go out in all directions through the earth. As they meet the various layers of limestone, sandstone, etc., a portion of their energy is reflected back to the surface. Sensitive geophones catch and record these "echoes" on strips of sensitized paper. The developed strips are turned over to technicians who interpret the records and plot the results on maps that show, with remarkable accuracy, where oil may be found. Thus, the use of a few pounds of explosives can often save drilling at a place where there is little or no chance of finding oil.

Representatives of the Explosives Department of Du Pont are well informed on the subject of seismic prospecting. They represent another of the many diversified groups in Du Pont who make their specialized knowledge available to the petroleum industry.

Chicago District Office Organizes One-Day Training Courses For Oil Company Personnel

In keeping with the Petroleum Chemicals Division policy of being of help to refiners in every way possible, Du Pont's Chicago district office has recently organized one-day educational clinics for oil company personnel.



Part of the Chicago District Laboratory showing two ASTM knock test engines in operation.

These clinics tie in with the indoctrination efforts of oil companies located in the Chicago area. Such companies periodically call in various of their personnel for training courses which take them through operations, credit, accounting, research and other departments.

The program offered by Du Pont is flexible. It consists of laboratory talks and demonstrations on Du Pont products, discussions on automotive maintenance, and safe handling practices in connection with TEL and other Du Pont additives.

A typical day's tour of Du Pont's Chicago facilities might start in the laboratory. Here the trainees would receive a thorough explanation of the function of the CFR engine. They would see one or more of these engines in operation.

At this point a slide talk on the motor method and the research method of determining octane numbers of gasoline might be introduced by Dr. A. B. Wilder, laboratory manager.

The response of gasoline to TEL would be described. Also the significance of the various physical tests that are normally applied to gasoline. The physical properties of TEL and other Du Pont additives would also be made clear to the students in the course.

ADVERTISEMENT — Prepared for the Petroleum Chemicals Division of E.I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED Training Courses

Another feature on the program would include a talk by H. E. Cissley who is the Du Pont fleet, bus and tractor expert in the Chicago district. With an impressive background in truck manufacture and maintenance covering many years, Mr. Cissley can be counted on to give an interesting and instructive presentation on the subject of maintenance and other problems concerning automotive equipment.

In the matter of safe handling practices connected with TEL, tank entries, tank cleaning, and hazards having to do with tetraethyl lead in general, Frank Grubb gives a presentation that always proves interesting to his hearers.

At the end of a full and strenuous day, the meetings are brought to a close with a brief portrayal of other Du Pont departments, products and operations.

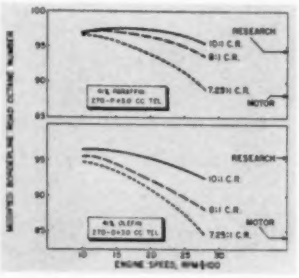
From this there is invariably one conclusion – the petroleum industry contributes much to Du Pont . . . and Du Pont, with its additives and finishes, its neoprene and nylon, its explosives and chemicals – and its research – in turn contributes much that is of value to the petroleum industry.

Road Tests Show Effect of Compression Ratio on Road Octane Rating

To examine the fuel chemical characteristics involved in obtaining maximum road antiknock performance and lead response, Du Pont's Petroleum Laboratory has conducted an extensive series of road tests. These tests were made in cars with engines representative both of today's designs and those of the future. In the program, a total of some 2500 separate road ratings were made on 42 leaded and unleaded gasoline blends.

One of the major conclusions drawn from this work was that in high compression ratio cars, at high speed, the road ratings of the fuels increased markedly with compression ratio, thus making the road octane numbers of fuels more nearly constant throughout the speed range.

Typical examples of the effect of increased compression ratio causing an increase in road octane rating are shown in the graph for two fuels, one containing all paraffins (270-P) and the other all olefins (270-O) in the 270°F.



Typical effect of compression ratio on the borderline ratings of two types of test fuels.

to E.P. fraction. This tendency toward increased road octane rating in the high speed range with increasing compression ratio was consistent with all of the test fuels.

Complete data and results of this project are available in a paper, "The Effect of Hydrocarbon Structure on the Road Antiknock Performance of Motor Fuels."

Medical Director for Petroleum Chemicals Division

DR. STEWART L. RANKIN is medical director of the Du Pont Petroleum Chemicals Division. He and his associates are at the service of customers at all times to help safeguard the health of employees working with TEL compounds.

Dr. Rankin graduated from Bucknell University with a Bachelor of Science degree in biology in 1926. He then studied at Jefferson Medical College, receiving his M.D. degree in 1930. After a period as an insurance company medical examiner, he became assistant director of Student's Health Service at Lehigh University.

Dr. Rankin joined the medical staff of Du Pont's Chambers Works in 1937. In 1940 he was appointed a physician at the Indiana Ordnance Works, a Du Pont built and operated war plant. He later became medical supervisor at this

plant. In 1944 he was made superintendent of the medical department of the TEL plant at Baton Rouge, Louisiana. In 1946 he came to Wilmington.

LITERATURE AVAILABLE

The Petroleum Chemicals Division of Du Pont has published a wide variety of material of interest to the petroleum industry. This includes technical papers, bulletins, reports and memoranda as well as equipment operation bulletins, safety regulations, tank cleaning data, marketing aids and the like.

Any of this is available on request to your nearest Du Pont Petroleum Chemicals Division District Office. A partial listing of available material is shown below:

Blending Calculator for Du Pont TEL Compound (Aviation Mix) Serial A-1210

Tank Talk–A 32-page booklet which outlines safe procedure for cleaning gasoline storage tanks. Written for the man who does the cleaning Serial A-1134

Du Pont Services to the Petroleum Industry Serial A-663

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Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.)
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A-1846

Printed in U. S. A.

Guard Your Family STRIKE BACK!

GIVE to Conquer Cancer

IF SOMEONE IN YOUR FAMILY HAD CANCER, you would do anything . . . everything that would help. And today there is so much that you can do to help. Tens of thousands of families just like yours meet cancer every year and triumph over it. But we are still losing too many men and women we love.

Doctors can now cure half of those who develop cancer if the disease is diagnosed in its early stages. Yet in 1950 some 210,000 families lost a father, a mother or a child to cancer. Many of them—probably 70,000—could have been cured.

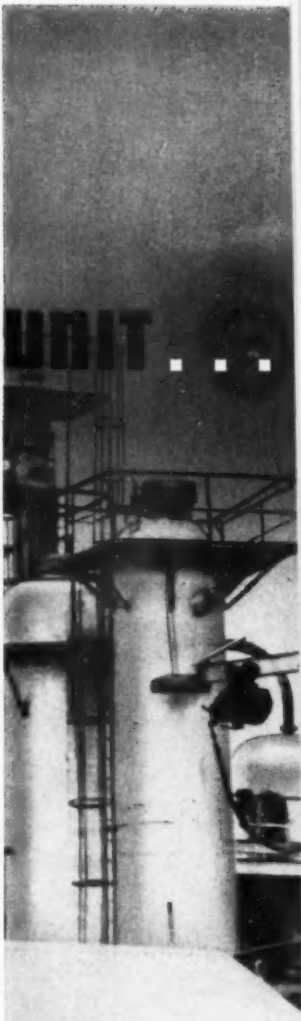
To save more lives, we all must help.

Your gift to the Cancer Crusade will help guard your family by providing more research, more life-saving education, more training for scientists and physicians, more equipment, more services for those already striken with the disease.

Cancer is man's worst enemy. Striking back at cancer costs money. Any contribution is welcome but, the fight against this major threat deserves major support: dollars—tens—twenties —hundreds of dollars. Will *you* help?

AMERICAN CANCER SOCIETY

UOP PLATFORMING UNIT . . .



● The first UOP Platforming unit to be installed in Canada will be built at Canadian Oil Companies' new eighteen million dollar refinery now being constructed at Froomfield, Ontario.

Canadian Oil selected a 3800 barrel per day unit to produce high octane aviation gasoline components, chemicals important to the production of synthetic rubber, nylons and plastics, and for upgrading low octane natural and straight run gasolines.

This first Canadian installation is further evidence of the preference for Platforming—a fact that is fully substantiated by the number of units—ranging from 900 to 16,000 barrels per day—currently in various stages of design and construction for both major and independent refiners.

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General Offices: 310 S. MICHIGAN AVE., CHICAGO 4, ILL., U. S. A.
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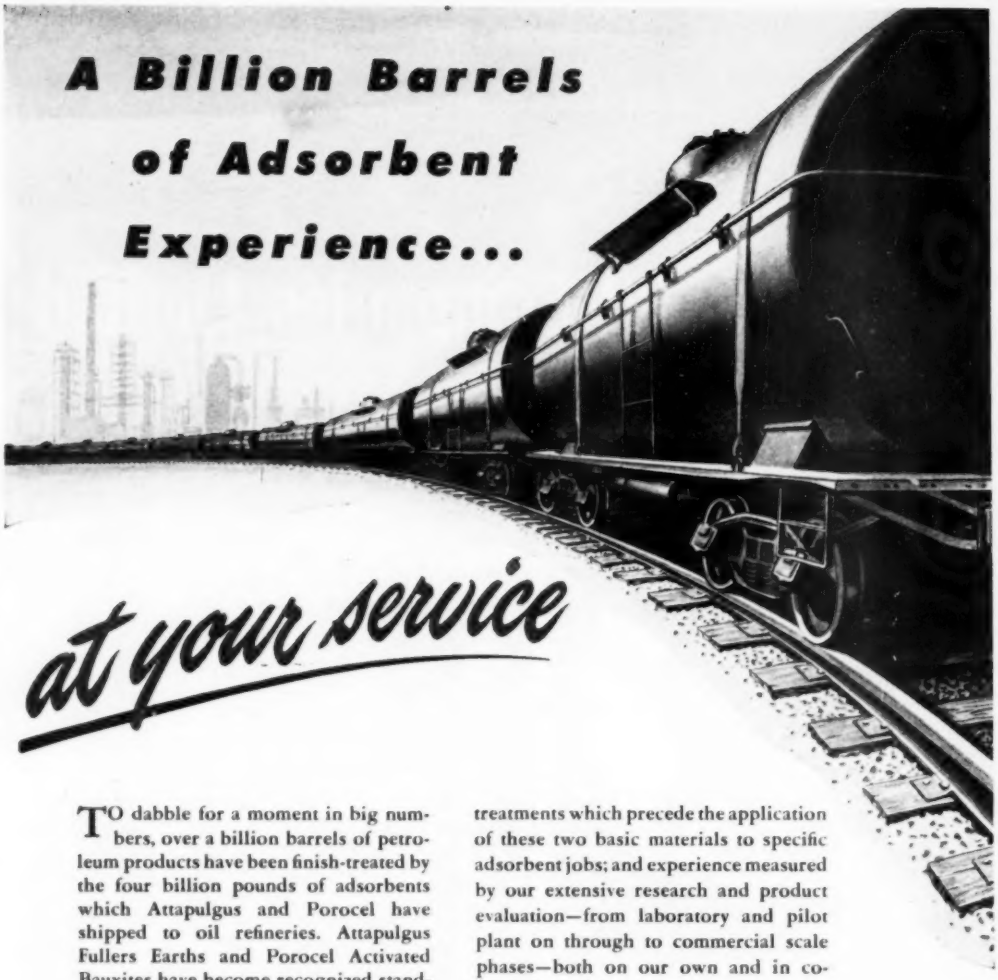
Universal Service Protects Your Refinery

The market belongs to the refiner who serves it best

(To obtain more data on advertised products see page 432)

A Billion Barrels of Adsorbent Experience...



at your service

TO dabble for a moment in big numbers, over a billion barrels of petroleum products have been finish-treated by the four billion pounds of adsorbents which Attapulgus and Porocel have shipped to oil refineries. Attapulgus Fullers Earths and Porocel Activated Bauxites have become recognized standards in the removal or reduction of odors, colors, tastes, moisture, acids, sulfur, fluorides and unsaturates, and for solid catalyst purposes. And in this wide range of services, remarkable finished value was gained in a long list of petroleum cuts—from the lightest distillates to the heaviest lubes and waxes.

This all adds up to a lot of adsorbent experience—experience with the many treatments which precede the application of these two basic materials to specific adsorbent jobs; and experience measured by our extensive research and product evaluation—from laboratory and pilot plant on through to commercial scale phases—both on our own and in cooperation with our customers.

So there's great merit to the suggestion that it pays to consult Attapulgus and Porocel. In your own plans to improve products or expand output, perhaps our one billion barrels of adsorbent experience can be of real help to you in selecting the right adsorbent and the right conditions. Our laboratory and process staff are at your service, without obligation.

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PETROLEUM PROCESSING
APRIL, 1951

How to Get MRO Materials

New M-46 Priority Order Helps Refiners Secure Needed Maintenance, Repair, Operating Supplies

By WILLIAM F. BLAND, Engineering Editor

WASHINGTON—Refiners and other petroleum processors can now use a new priority system of the National Production Authority to secure maintenance, repair and operating (MRO) materials and supplies for their plants. They can also use it for minor capital additions not exceeding $1000 in material cost.

The new priority system was issued by NPA March 12, and went into effect March 15. It is known as NPA order M-46, and is being administered by the Petroleum Administration for Defense.

Although formal priorities assistance authorized under M-46 is now limited to MRO materials (and oil country tubular goods), PAD's Materials Division is prepared to give informal assistance in urgent cases to members of the oil and gas industries in obtaining materials, equipment or supplies needed for other purposes, according to Interior Secretary Oscar L. Chapman, PAD Administrator.

An earlier order issued by NPA Feb. 27, Regulation 4, established a general MRO priority system for all industry and business. The new M-46 order applies specifically to the petroleum and gas industries and was found necessary because Reg. 4 "does not meet specialized requirements of these industries."

Actually, a refiner can use either of the two systems—and now finds himself in the position of having to make a choice between them. He can't however, use them interchangeably to suit his own purposes.

Both M-46 and Reg. 4 employ the same rating—DO-97, which has equal preference with DO ratings used for handling defense.

Comparison—M-46 and Reg. 4

From a refiner's viewpoint, it would appear to be to his advantage to operate under the M-46 order, tailored specifically to meet his needs. If he does, he'll find himself with less bookkeeping work, more freedom on the amount of MRO material he can purchase, and a higher ceiling on the minor capital additions he can make.

He'll also find a staff of men at PAD in Washington who know the petroleum industry, can appreciate his problems, and are set up to give him fast help when he needs it—assistance he might not get at NPA under Reg. 4. PAD, remember, has nothing whatsoever to do with Reg. 4.

On the other hand, under M-46 a refiner has to get PAD approval on some MRO orders.

Here are the salient features of M-46 compared with Reg. 4:

Quotas—M-46 puts no limit on the amount of MRO materials that a refiner can order. Reg. 4 specifically limits MRO purchases to the dollar value of such materials purchased in 1950—unless a request for a higher quota is approved by NPA.

This feature means that a refiner electing to operate under Reg. 4 will in many cases have to do a lot of extra bookkeeping—first to determine his 1950 expenditures for MRO materials in order to establish his quota, and then to make sure that his current MRO expenditures don't exceed that quota.

Capital Additions—M-46 doesn't specifically mention capital additions. Under the definition of "maintenance and repair," however, it includes (without regard to accounting practice) "any other use of material not exceeding in material cost $1000 for any one complete operation which has not been subdivided for the purpose of coming within this definition." PAD officials are interpreting that to include capital expenditures.

Reg. 4 permits the use of the DO-97 rating for "minor capital additions" where the "total cost of materials used does not exceed $750 for any one complete capital addition."

Approval—Under M-46 a refiner must get approval from PAD before placing any order for MRO material for a total amount of $2000 or more, or for any single item costing more than $1000. No approval is required from any government agency under Reg. 4—as long as a purchase is within the quota limits.

Laboratory Equipment—M-46 specifically includes authorization to apply the DO-97 rating to orders for laboratory equipment, which is defined as meaning "materials or equipment used exclusively for the purpose of controlling, or investigating more effective methods of conducting, petroleum and gas industries operations by means of research, technical or control laboratories." Reg. 4 doesn't mention laboratory equipment, but presumably laboratory supplies and materials of an "expendable" nature would be allowed if for use in connection with operations (e.g.—technical service and control laboratories), as well as capital additions up to $750.

Administrative Supplies—M-46 provides for ordering materials to be used for administrative operations (office supplies, office equipment and machinery, and the like), except that here quotas are established, either based on the dollar value

THESE MEN HELP PLANT OPERATORS SOLVE MATERIALS PROBLEMS

WILSON—Refining

WATTS—Director

PAD's Materials Division is staffed almost entirely with experienced industry men—many of whom served with the old Petroleum Administration for War during World War II. They know the petroleum and gas industries and their special problems, and are set up to help refiners and other petroleum operators secure the supplies needed to keep plants running at full capacity. Here's the lineup:

Frank A. Watts, Director—With Humble Oil and Refining Co. since 1919: in engineering and construction work for 19 years, as general purchasing agent for six years, and as sales manager until joining PAD.

Herbert R. Hansen, Assistant Director—On leave from Superior Oil Co., where he was director of purchases. From January 1942 until August 1943 he was on the staff of PAW as a materials specialist and later as assistant director of the Materials Division.

Roy B. Wilson, Chief, Refining Materials Branch—Handles materials required for operation of refineries, including catalysts, TEL, inhibitors and additives. A graduate of Lafayette College, with a B.S. in chemistry; went to work for Sinclair Refining Co. in 1929 as assistant construction engineer of the company's refinery at Wellsville, N. Y. Has been resident engineer at Wellsville since 1932, except for period from April 1942 to August 1944 when he was chief of Priorities Section of PAW's Construction Division.

WEBBER—Nat. Gasoline

HANSEN—Asst. Director

Charles E. Webber, Chief, Natural Gasoline and Gas Materials Branch—Handles materials required for operation of natural gasoline plants, for gathering, processing, compressing, transmission and local distribution of natural gas, and for production and distribution of manufactured gas. Has been in petroleum industry since 1934; joined PAW's Natural Gas and Gasoline Division in 1942 and later became assistant manager of the division; since 1945 assistant manager of Sun Oil's Natural Gas Division.

Theodore N. Herman, Jr., Chief, Chemicals Branch—Responsible for all chemicals required for petroleum industry operations. Has been with Petrolite Corp. since 1926, specializing in problems in dehydration, desalting and corrosion prevention.

HERMAN—Chemicals

AUSTIN—Foreign

E. G. Austin, Chief, Foreign Materials Branch—Responsible for the distribution of materials for foreign petroleum operations. Has worked with California Standard and affiliates since 1935, most recently as vice president of Aramco Overseas Co.

Other members of PAD's Materials Division are listed in the PAD Directory on the next page. Yet to be activated is a Projects Branch, to handle materials problems involved in construction of new or expanded facilities, such a cycling plants and refineries.

of such materials purchased in 1950, or established by PAD upon request of an operator for a larger quota. Reg. 4 doesn't specifically mention administrative supplies, but presumable would include them as necessary operating supplies.

Emergencies — M-46 provides a means for fast approval of an order by PAD if an emergency situation arises in a specific plant. No such provision is included in Reg. 4.

How to Use DO-97 Rating

To use the DO-97 priority rating to obtain delivery of MRO materials under M-46 (except for administrative supplies) an operator should place the rating "DO-97" on each delivery order for material, together with the statement "The undersigned certifies that the rating hereby applied is authorized by and is properly used pursuant to the provisions of NPA Order M-46."

If the order is for a total amount of $2000 or more or if any single item in the order costs more than $1000, two copies of the order must be submitted to PAD for approval. PAD wants the actual order (or copies of it), giving order number, name of vendor, price, description of material being ordered, and similar pertinent information; PAD doesn't want merely a purchase requisition or a memorandum or letter describing the order. Assuming approval is granted, PAD will so indicate on the original copy of the order and return it to the operator, who may then place the order with his supplier. The second copy of the order will be retained by PAD.

If the order is for a total amount of $100 or more, but less than $2,000, and doesn't contain any single item costing more than $1000, approval from PAD is not necessary. At the time the order is sent to the vendor, however, a copy of it must be sent to PAD for information.

If the order is for less than $100, no copies need be sent to PAD.

In the case of orders for administrative supplies, the same DO-97

Where to Write

All communications concerning M-46 are to be addressed to the Petroleum Administration for Defense, New Interior Building, Washington 25, D. C., Attention: Materials Division.

rating and the same certifying statement is used. No approval is required from PAD, regardless of the size of the order, although the operator must stay within his quota—as determined either by 1950 purchases or by PAD upon application.

All MRO materials, of course, won't have to be ordered under priority. In fact, M-46 prohibits the use of the rating to obtain materials which can be secured otherwise, or to secure materials "the use of which could be eliminated without serious loss of efficiency by substitution of less scarce material, or by change of design."

Emergency MRO Material

One very valuable provision of M-46 is the mechanism it provides for priority assistance in securing emergency MRO material. When there has been an actual breakdown or suspension of operations and there isn't sufficient time to get the necessary materials following the procedure outlined above, an operator may phone or wire the PAD Materials Division for assistance. He should give PAD the date of the actual breakdown or suspension of operations and the operations affected, the equipment to be repaired and its function in maintaining continuous operation, the price, quantity, and a detailed description of the material required including the number and the date of delivery orders for it, and the supplier from whom it is to be obtained. If submitted over the telephone, the information must be confirmed within three days by letter or wire. The actual delivery order for emergency MRO material need not be submitted to PAD, but an operator may not place such an order with a DO-97 rating until PAD approval has been received. In all probability, PAD would wire that approval immediately upon receipt of the necessary information, and the wire or a copy of it could then be attached to the order.

Other Regulations

Two other NPA regulations are of direct interest to operators using the M-46 order.

NPA Regulation 1—The inventory controls established by this order still apply, and M-46 doesn't authorize an operator to secure material in excess of the limitations spelled out by Reg. 1.

NPA Regulation 2—This order sets up the basic rules of the priorities system, such as the sequence in which rated orders are to be filled, and how changes in an order once placed affect that order's rating.

Copies of any or all of these orders (M-46, Reg. 1, Reg. 2, Reg. 4) can be obtained from the National Production Authority, Department of Commerce, Washington 25, D. C., or from the editors of PETROLEUM PROCESSING.

DIRECTORY OF PAD ADMINISTRATIVE PERSONNEL

(as of March 26, 1951)

ADDRESS: Department of Interior, E. St., between 18th and 19th N.W., Washington 25, D.C. **PHONE:** REpublic 1820

Division	Position	Name	Room	Ext.
DEPUTY'S OFFICE	Deputy Administrator	Bruce K. Brown	6654	3831
	Asst. Deputy Administrator	Hugh A. Stewart	6643	4164
	Asst. Deputy Administrator—Domestic Industry Operations	Alfred P. Frame	6648	3891
	Asst. Deputy Administrator—Foreign Operations	C. Stribling Snodgrass	2023	3165
	Asst. Deputy Administrator for Gas	Charles Pratt Rather		
	Special Assistants	Carroll D. Fentress	6647	2653
		Joseph V. Machugh	6450	2282
		Bernice Kirschling	6655	667
LEGAL	Asst. Deputy Administrator and General Counsel	Justin R. Wolf	6646	4872
PROGRAM	Director	Cecil L. Burrill	6458	2728
	Assistant Director	Robert N. Sears	6454	4722
PRODUCTION	Director	Richard G. Lawton	6649	4934
	Assistant Director	Millard K. Neptune	6649	4934
REFINING	Director	Reid Brazell	6459	5343
	Assistant Director	Thomas L. Apjohn	6455	2312
	Asst. Director, Aviation Fuels	Walter C. Huffman	6455	4507
	Special Asst. to the Director	E. Oliver Jones	6449	3727
SUPPLY AND TRANSPORTATION	Director	Dene B. Hodges	6443	2797
	Assistant Director	William P. Hayes	6445	5323
	Consultant	John W. Boatwright	(*)	2716
FINANCE COUNSELOR	Special Assistant to Deputy Administrator	George Gibson	2552	3116
MATERIALS	Director	Frank A. Watts	2540	5397
	Assistant Director	Herbert R. Hansen	2546	3380
	Chief, Production Materials Branch	Charles T. Reichert	1070	3097
	Chief, Refining Materials Branch	Roy P. Wilson	2548	2986
	Chief, Natural Gasoline and Gas Materials Branch	Charles E. Webber	2548	2967
	Chief, Chemicals Branch	Theodore H. Herman, Jr.	2556	3469
	Chief, Equipment Manufacturers Branch	George E. Oller, Jr.	1070	5354
	Chief, Foreign Materials Branch	Edmund C. Austin	2544	3380
	Chief, Transportation Materials Branch	Otto E. McClatchey	2058	5351
	Chief, Marketing Materials Branch	Rolland P. Wood	2550	4752
	Chief, Statistical Analyses Branch	Earl L. Struwe	2056	5355
FOREIGN	Director, Foreign Refining	George T. Ballou	2025	770
PUBLIC INFORMATION	Director	Bryant Putney	6654	5333
ADMINISTRATIVE	Director	William F. Littlejohn	2547	4430
	Assistant Director	Russell W. Slight	2545	4363
MANPOWER	Manpower Specialist	Preston M. Bannister	6450	2282

* Mr. Boatwright and staff have office space in Arlington, Va.; telephone calls are still handled through the Interior Department (REpublic 1820).

NEWS in VIEWS

Photo courtesy Standard-Vacuum Oil Co.

U. S. OIL TECHNOLOGISTS are lending a hand in rehabilitating the bomb-damaged Wakayama refinery near Osaka in Japan. Operated by Toa Nenryo Kogyo, a Standard-Vacuum Oil Co. subsidiary, the 10,000 b/d refinery is presently charging 5,500 b/d. Latest unit to go on stream is the 3,500 b/d thermal cracker shown in the background above, built largely of equipment and material salvaged from the old plant. Refinery technicians pictured are (left to right): K. Kokubun, Toa Nenryo; G. J. Doll and L. D. Burritt, Standard Oil Development Co.; H. J. Hall, on loan from Esso Standard's Baton Rouge plant; H. Ishikawa, A. Matsuyama and M. Furihata, all of Toa Nenrvo, H. E. Luffman, Standard-Vacuum, and A. E. Dean, SOD

Petroleum Processing this month introduces another new feature to its readers—"NEWS in VIEWS." Each month it will present a selection of photographs of interesting events that have taken place in recent weeks. Not all the pictures will be "news" (such as Sohio's award for pollution control); some may be strictly "views" (such as Texaco's blood typing program)—but then who objects to a view now and then. We'll try to pick out the most interesting photos that cross our desks or that we can scare up—as long as they have some connection with petroleum processing operations. We think you'll like them.

—Editors

Official U. S. Navy Photograph

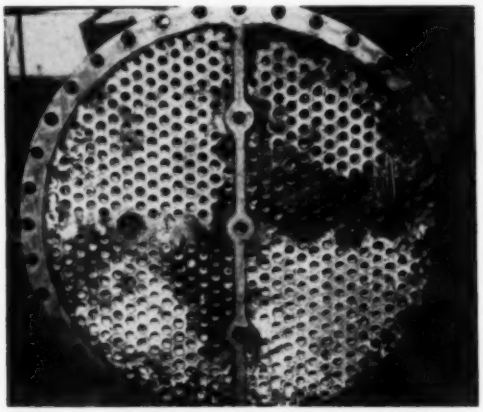
SAFE HANDLING of petroleum products (in this case kerosine) is demonstrated at the Second Petroleum Operations Course by J. E. Jeffries, asst. safety director for Jersey Standard. The two-week course was conducted by the Fuel Division, General Supply Depot, Naval Supply Center at Norfolk, Va., and was attended by 30 military and civilian personnel representing all branches of the armed services

EMERGENCY STEAM needs at Sun's Marcus Hook, Pa., refinery are being met by 12 railroad locomotives on sidings inside the plant. Increased demands for military avgas last Fall began to overburden the plant's existing steam facilities. To bridge the peak winter demand while new steam capacity was being installed, the company leased the dozen locomotives from the Pennsylvania and Reading Railroads. The engines' boilers were modified to burn refinery gas instead of coal

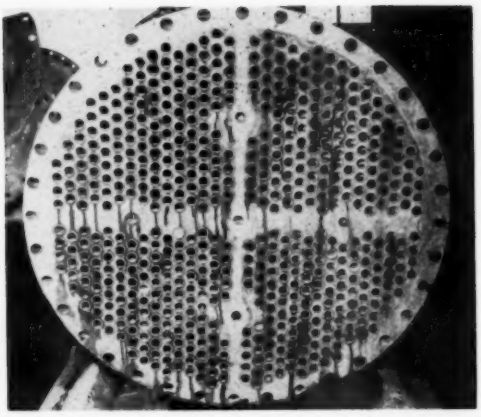
FOR POLLUTION CONTROL at its refineries, Standard Oil Co. of Ohio on March 18 received a special "citation of merit" from the Ohio Conservation Congress—the first time that group has given such recognition to any Ohio industry. Elliott B. McConnell (left), Sohio's vice-president, accepted the award from Pat Patterson, Congress president. Sohio has spent over $2-million for new oil-water separators at its Toledo and Cleveland refineries, and has a similar project under way at Lima

DISASTER CREWS have been organized at the Bayway (Linden, N. J.) refinery of Esso Standard Oil Co. to cope with emergencies that may arise either within the plant or in the surrounding area, and are affiliated with the recently organized Linden Industrial Disaster Units. Members of the crews are trained in first-aid and rescue work, including the use of acetylene torches, such as above, to free trapped victims.

BLOOD-TYPING of all refinery and other employees wherever it has health divisions is being undertaken by The Texas Co. to speed the making of blood transfusions in event of emergencies. Esther McKiernan, health division technician, is determining blood-type for a group of samples. After being "typed," each Texaco employee is given a card for wallet or purse showing his blood-type, name, address and phone number.



BEFORE tube bundle was put in Shell's pickling bath it looked like this



AFTER the pickling bath treatment and washing with 650 psig. water, the bundle looked like this

Is Your Problem

CLEANING EXCHANGERS?

This Refinery Uses All Techniques, Including Pickling, High Pressure Water, Sandblasting

QUICK-ACTING VALVE is useful part of the wet sandblasting nozzle

ONE of the tougher jobs around a refinery is keeping heat transfer equipment clean. Ingenious maintenance engineers in every plant are searching constantly for better ways to accomplish this job. Some methods currently employed have been discussed previously. (1, 2) In all cases, techniques or combinations of methods must be adopted which are best fitted for the specific deposits or scales to be removed.

For example, three different methods in use at the Houston refinery of Shell Oil Co. are each adapted to a particular cleaning problem. They are (1) mechanical cleaning, (2) chemical cleaning, and (3) wet sandblasting.

Mechanical methods include the use of a commercially-available, water-jet nozzle and also a company-designed rotary drill, operated with flushing water. Chemical procedures include in-place flushing with acid-type solvents, and pickling the bundles in an acid bath followed by washing with high velocity, high pressure water jets. Wet sandblasting is performed with portable equipment on an open-air rack.

The plant, a 110,000 b/d refinery, expects to clean in the neighborhood of 400 bundles during 1951. Last year, the total was about 375, and for the four years prior to 1950, the shops cleaned an average of 300 bundles annually. The current increase is believed to be due primarily to an increase in time between turnarounds and to higher throughput rates.

At the present time, 90% of the plant's tube side cleaning is being done by wet sandblasting, which has proved very efficient and economical. On occasions where

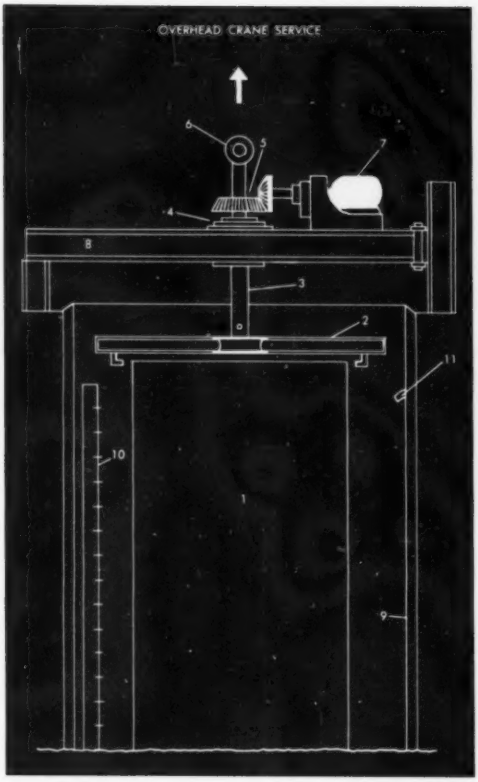


FIG. 1—PICKLING WELL for tube bundles. Numbers in drawing are covered by description in accompanying article

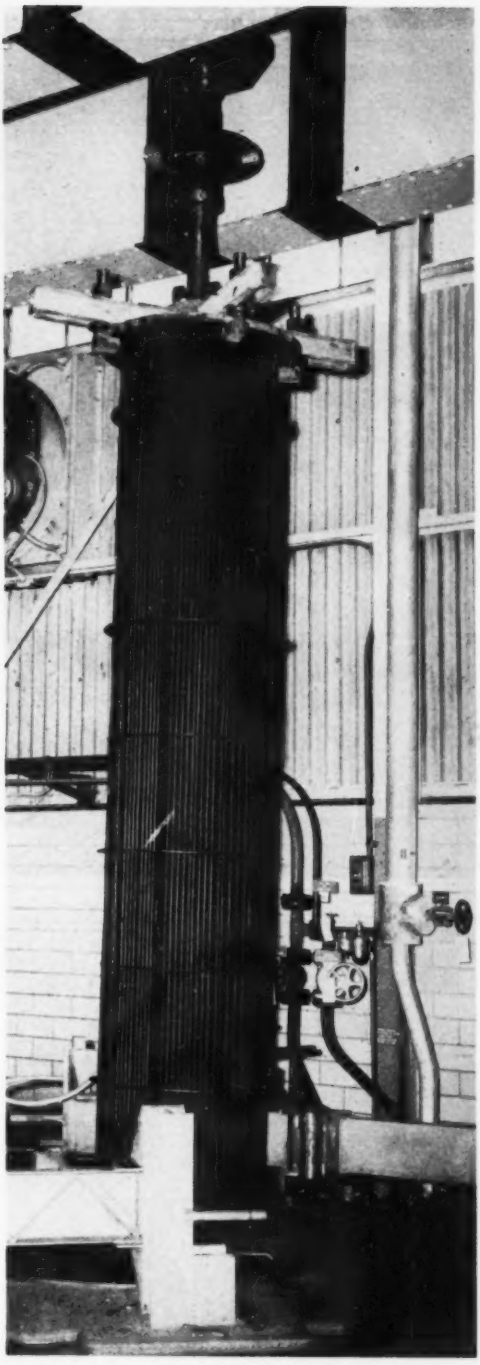
tubes are completely plugged, this practice must be preceded by mechanical cleaning.

Chemical cleaning of bundles in the shop is currently done in a recently-installed pickling vat. As shown in Fig. 1 and the photograph, a 16-ft. deep tank is placed below the floor and serviced by an overhead crane. The tube bundle is lowered into the well and rotated at about 8 rpm, in heated solvent which is air agitated. After pickling for an appropriate length of time, the solvent is pumped out of the vat. The bundle continues to rotate and is jetted with 650 psig. water, which knocks off and flushes away the loosened deposits.

Individual parts in the pickling well, as designated by the key numbers in Fig. 1, are (1) the tube bundle, (2) sling beam, (3) drive shaft, (4) thrust bearing, (5) bevel gears, (6) lifting eye, (7) gear-motor, (8) double swing beam, (9) pickling tank proper, (10) water spray jets, and (11) solvent inlet.

On bundles with large amounts of fairly loose deposits on the outside of the tubes, the time for cleaning in this pickling vat averages four hours, as opposed to using four men eight hours for washing and rodding the cleaning lanes. Examples of a tube bundle before and after cleaning in the well are shown in the photographs.

In-place chemical cleaning is being handled with the portable equipment illustrated in the sketch in Fig. 3. Generally, an Oakite solvent solution, dependent on the type of deposit, is used. The steam coil-heated solvent tank is mounted on one skid; the 75 gpm. circulating pump and its 10 hp. steam turbine drive are mounted on



TUBE BUNDLE POSITIONED ready for lowering into pickling well

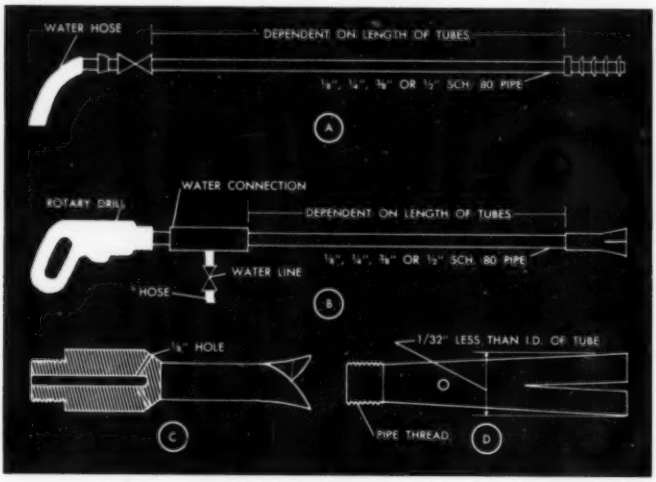
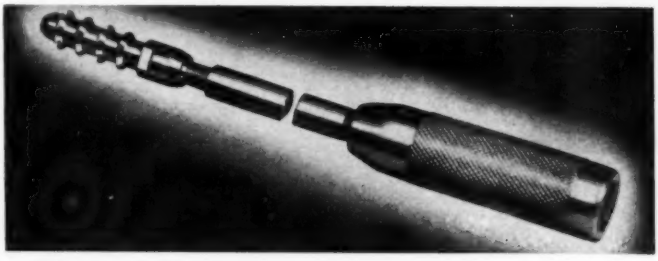


FIG. 2—MECHANICAL TUBE CLEANING equipment: (A) hydro-jet, (B) fish-tail drill, (C) (D) detail of fish-tail bit. Detail of hydro-jet bit below



another skid. To aid in flexibility of temporary cleaning set-ups in the field, rubber hose is employed for connections. The return line from the heat exchanger has a tap for sampling.

Chemical cleaning in-place has thus far been used to a limited extent. It has produced good results where only a few tubes or none at all are plugged. However, Houston shop personnel believe that the possibilities of real savings through this method are extremely good. As a result, a study is now under way to improve their methods with this technique. Plans are also being made to use a portable hydraulic cleaning unit similar to the one used at Shell's Wood River refinery.[2]

Mechanical cleaning is most useful on scale which is hard and insoluble, or where many tubes are plugged. The tools used are shown in Fig. 2 and the photograph. Completely plugged tubes are drilled with the company-designed "fish-tail" bits. The bit has small holes to provide for flushing water, and is screwed on to a length of pipe and driven by a rotary drill. Size of the bit and length of the pipe varies with the size of the tubes being cleaned.

On the few scales which are too soft and wet to sandblast or to handle with the rotary "fish-tail," the shop uses C. F. Braun Co. "Hydro-Jets." The Hydro-Jet has a series of circular blades, each of which is notched. Small holes behind each blade are provided so that water can flush away the scale as the blade scrapes it loose.

Wet sandblasting follows a fairly conventional procedure. The shop uses a Pangborn Corp., Model AS-2 wet sandblasting machine and does

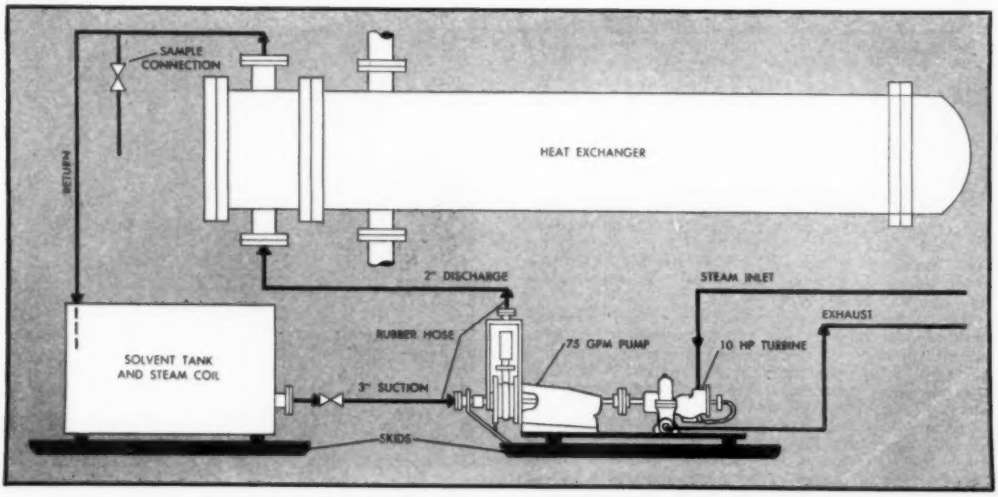


FIG. 3—PIPING ARRANGEMENT for the portable chemical cleaning equipment

the work out-doors on a rack (see photographs). A quick-acting valve and a nozzle which will fit into the end of the exchanger tube are employed. A cover to catch the sand and water as it emerges from the tubes is necessary for safety and cleanliness. Most deposits except very hard scale and viscous sludge are easily removed by this method. Usual procedure is to drill out any tightly-plugged tubes and then send the bundle to the sandblast rack.

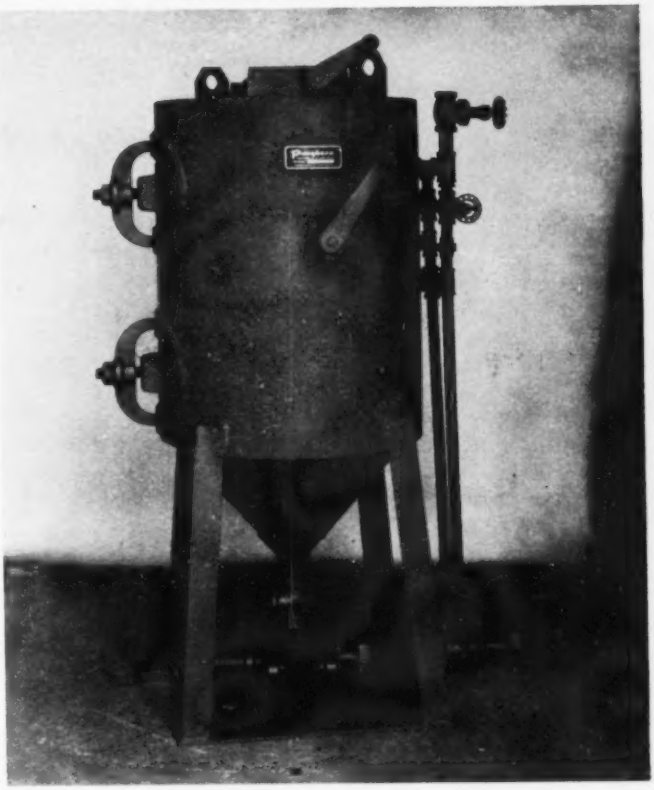
The Pangborn AS-2 wet sand blast machine can be operated continuously by keeping the hopper refilled about once every ten minutes. It is usually operated with a $\frac{3}{8}$-in. diameter nozzle, which at 90 to 100 psi. requires about 210 cfm. actual delivery and flows about 1000 lbs. of sand and 25 gals. of water per hr. (exclusive of rinsing). A No. 8 screen size sand is the abrasive most commonly used.

The machine stands about 5 ft. overall height, weighs approximately 1275 lbs. and has a sand capacity of 300 lbs. Speed of cleaning flat surfaces is said to average 4 to 6 sq. ft per minute, depending upon the accessibility of the surface and its condition.

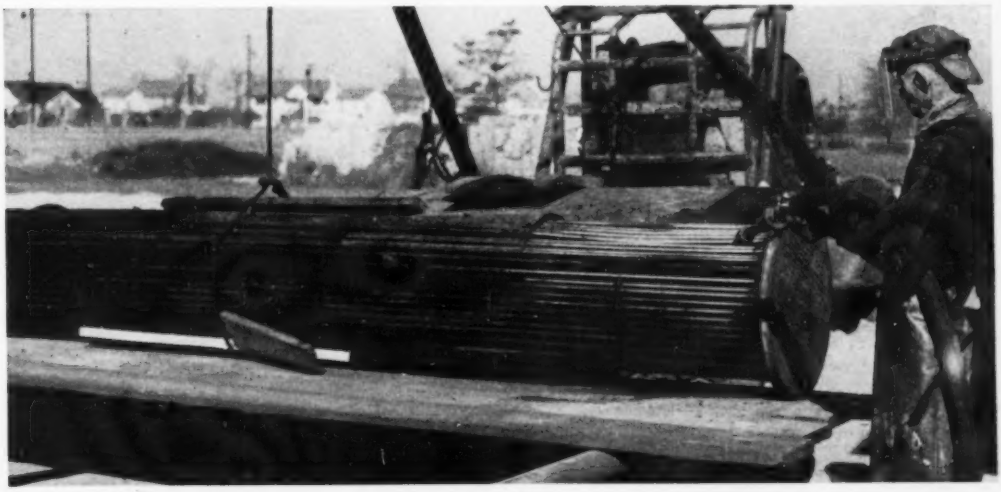
Shell finds the biggest cleaning savings have been achieved in the use of wet sandblasting, wherever possible, in place of hydro-jetting and tube with other practices, they state.

References

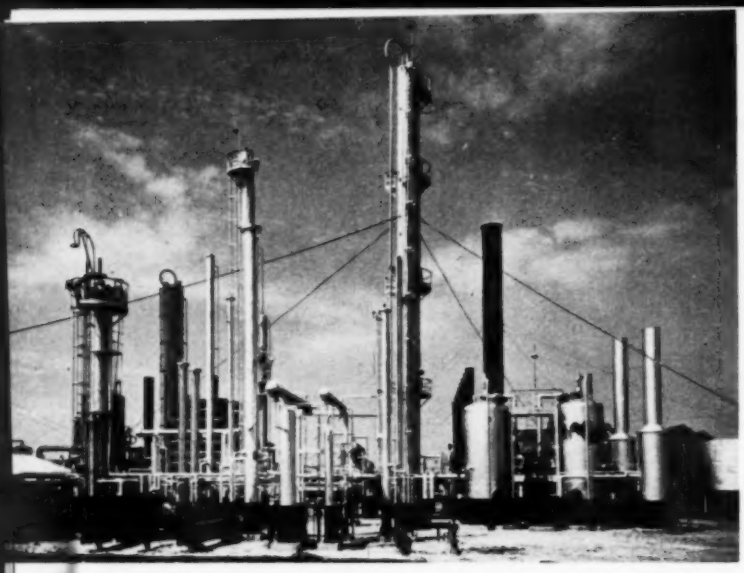
(1) "High Pressure Water plus Blasting Sand Equals Cleaner Heat Exchangers," William C. Uhl, PETROLEUM PROCESSING, January, 1951, pages 22-25.
(2) "Three Ways to Clean Exchangers," C. J. Wenger, PETROLEUM PROCESSING, February, 1951, pages 150-153.



WET SANDBLASTING MACHINE used by Shell, a Pangborn Model AS-2



OUTDOORS RACK holds tube bundle for wet sandblasting



GENERAL VIEW OF NEW FACILITIES. *Left to right: compressor house, poly reactor, crude fractionator, caustic and wash towers, DEA regenerator, H_2S absorber, depropanizer, debutanizer and ply gasoline stabilizer accumulators, poly gasoline stabilizer, Perco fractionator (large tower), Perco reactor cases, debutanizer reboiler, and steam superheater*

Small Refinery Becomes Competitive With Cat Reformer, Poly Units

By GORDON T. GRANGER, H. O. SIVESS, and K. W. SEED*

New units added to the previous processing train permit a 3500 b/d refinery to make premium as well as regular grade motor gasoline from East Texas crude without excessive lead requirements. Structural steel was saved by installing equipment at or near ground level wherever possible, and vessels and other items were salvaged from obsolete units.

A MODERNIZATION program of considerable magnitude has been completed at the Big Sandy, Texas, refinery of R. Lacy, Inc. which, for a small sacrifice of unused topping capacity, has greatly improved the octane quality of its gasoline. As with other small refiners, the matter of octane rating was becoming a seriously disturbing question, since the East Texas crude Lacy processes yields a rather low octane straight-run gasoline while the thermally cracked gasoline contains considerable sulfur.

The existing refinery topping capacity in operation amounted to 3500 b/d. Other equipment in operation included a 1500 b/d vapor-phase thermal cracking unit, a 2000 b/d vacuum asphalt plant and related associated product treating facilities. To this has now been added a 1300 bpsd Perco Cycloversion unit, a gas recovery system capable of handling 870 Mcfd, and a Universal Oil Products Co. catalytic polymerization unit making 72 b/d of high octane poly gasoline for blending.

A catalytic cracking unit was considered out of the question for the small volume of charge stock available. Also, it was desirable to desulfurize straight-run as well as cracked gasoline, whereas it was not desirable to retire the existing thermal cracker. A gas recovery system would be necessary regardless of the process selected, but at the same time a high production of gas was not wanted, due to the fact there is much natural gasoline and LP-Gas production already in the area. Combining catalytic desulfurization with reforming appeared to offer the best solution to the plant's pressing problems. Straight-run naphtha could be desulfurized or reformed to any desirable extent. Likewise, cracked gasoline could be desulfurized and the octane rating also upgraded if warranted (but at the expense of greater gas production). A combined stream could be similarly treated without resorting to "blocked" operations.

If the new facilities could be tied in with existing processes, additional advantages could be obtained. The "old" processing scheme then would not be disturbed.

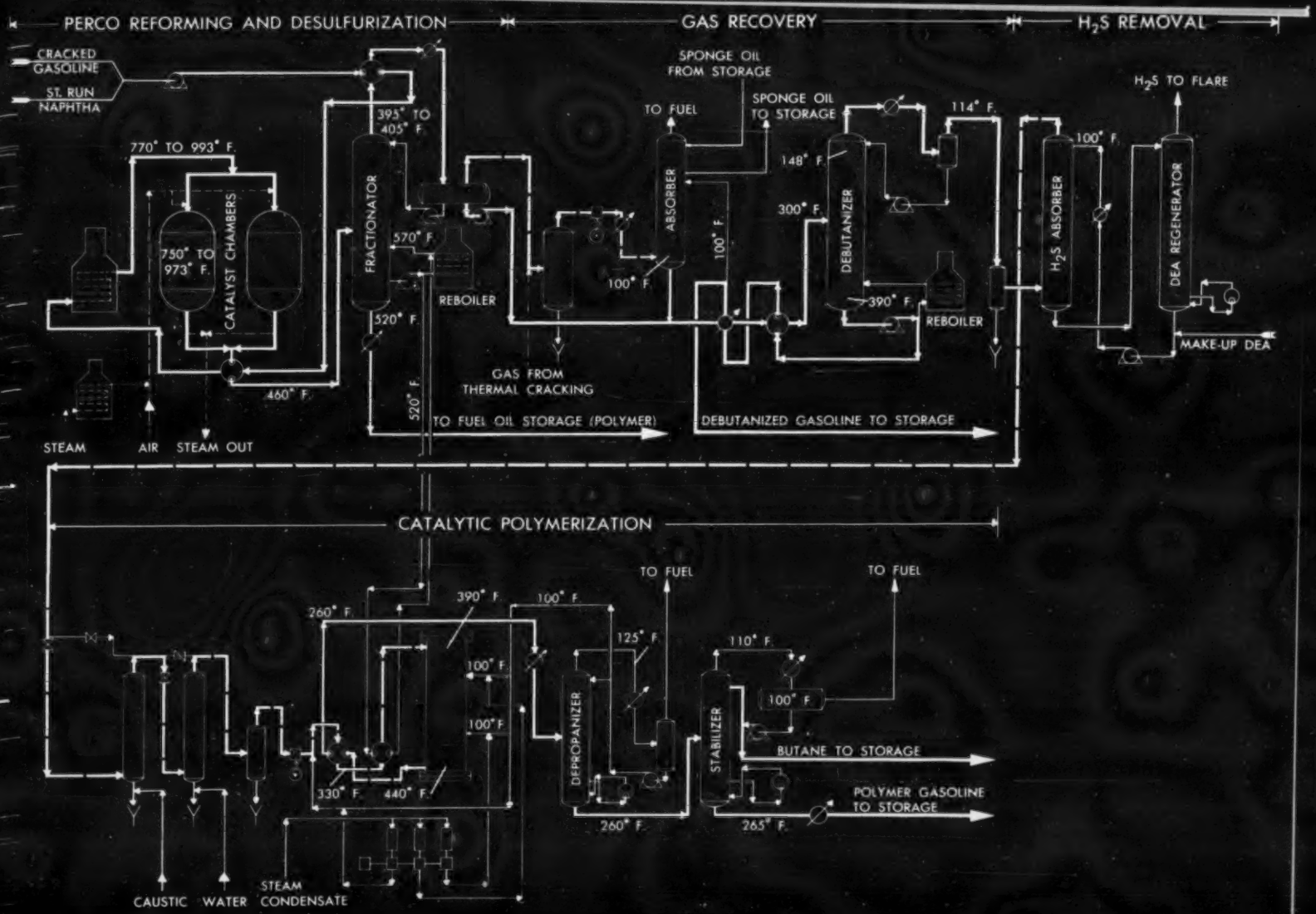
The engineering and design work was handled by the Ralph M. Parsons Co. and construction was a joint venture with the C. A. Turner Construction Co., both of Houston. There were a number of important considerations in design and construction.

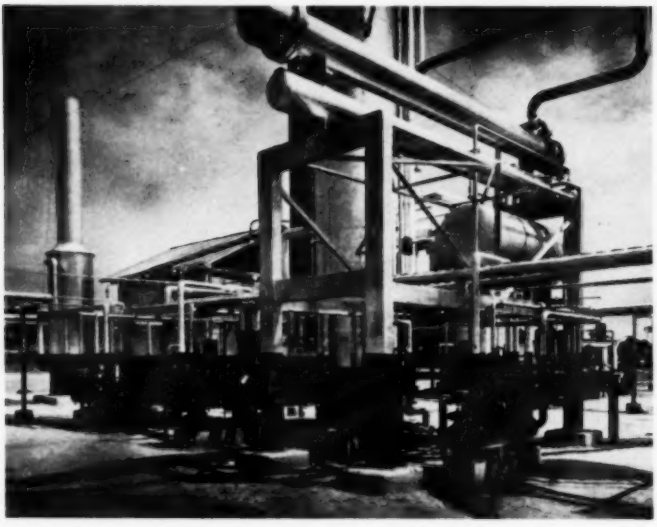
A very important factor was to install the new facilities as inexpensively as possible, without impairing useful life or operating flexibility or sacrificing safety. One of the requirements made of the engineering contractor, therefore, was to reduce structural steel use to the minimum practical amount by locating everything possible at or near ground level on concrete piers, and eliminate "frills." Salvaged steel, for example, could be used for pipe racks and much of the steel structure.

Wherever the question came up, the cost of structural steel use was compared first against the cost for concrete, and then against that for the appurtenances which otherwise might be necessary if located near grade. Where a cooler or exchanger, for instance, is in an elevated position, the receiver or communicating vessel

FIG. 1 (Right)—Process facilities at Big Sandy refinery

* Mr. Granger is with Ralph M. Parsons Co., Houston; Mr. Sivess with R. Lacy, Inc., Big Sandy, Texas; and Mr. Seed with Phillips Petroleum Co., Perco Division, Bartlesville.


PERCO REFORMING AND DESULFURIZATION
GAS RECOVERY
H_2S REMOVAL
CRACKED GASOLINE
ST. RUN NAPHTHA
770° TO 993° F.
750° TO 973° F.
CATALYST CHAMBERS
395° TO 405° F.
FRACTIONATOR
570° F.
REBOILER
520° F.
460° F.
520° F.
STEAM
AIR
STEAM OUT
GAS FROM THERMAL CRACKING
TO FUEL OIL STORAGE (POLYMER)
SPONGE OIL FROM STORAGE
TO FUEL
SPONGE OIL TO STORAGE
ABSORBER
100° F.
148° F.
300° F.
DEBUTANIZER
114° F.
390° F.
REBOILER
DEBUTANIZED GASOLINE TO STORAGE
H_2S TO FLARE
100° F.
H_2S ABSORBER
DEA REGENERATOR
MAKE-UP DEA
CATALYTIC POLYMERIZATION
260° F.
390° F.
100° F.
100° F.
100° F.
330° F.
440° F.
125° F.
DEPROPANIZER
260° F.
TO FUEL
110° F.
100° F.
STABILIZER
TO FUEL
BUTANE TO STORAGE
POLYMER GASOLINE TO STORAGE
265° F.
CAUSTIC
WATER
STEAM CONDENSATE



OPERATING SIMPLICITY AND ACCESSIBILITY feature this plant. Left to right: fractionator reboiler, charge heater and fractionator. Exchangers at top handle fractionator overhead to charge preheat. Pumps, left to right, handle Perco charge, fractionator reboiler circulation, poly feed, fractionator reflux, and debutanizer feed

serves as an exchanger support.

As the photographs of the plant clearly show, a surprising amount of equipment came down on the ground. There are no chain-operated valves and few ladders or elevated walks.

A second considerable factor in reducing costs was the incorporation of all the vessels and equipment possible from the idle 2000 b/d crude unit on the site as well as use of other idle equipment located elsewhere about the plant. This took care of the product fractionator for the Perco unit, charge heater and the gas recovery unit inlet scrubber. No alloy steel was used in the new vessels.

Up to this time the plant had neither gas recovery facilities nor a poly plant, since the low volume of gas as well as its small olefin content made it uneconomic. But with the Perco unit added, although its gas production under normal operations is relatively small, the combined gas production of the thermal cracker and the Perco now makes recovery and polymerization worthwhile.

Consequently, the gas recovery plant is designed to handle gases from thermal cracking as well as those from the Perco unit. For final clean up of absorber gas released to fuel, a recycle gas oil slip-stream is taken from the thermal cracker. Excess propane over that required to quench the polymerization unit is not sufficient to warrant disposal other than as part of the plant fuel gas. H_2S from gas treating is flared.

Plant Operation

A flow sheet of the new facilities indicating process streams coming from the original plant is shown in Fig. 1. The charge may be either cracked or straight-run gasoline, or a blend of the two. Currently the plant is running on a blocked operation.

Incoming charge is heat-exchanged against the fractionator column overhead (to save heat and reduce the load on the plant cooling towers) and Perco reactor effluent, thence to a heater. This was the old crude unit heater. Charge enters the reactor at 730° to 950° F, depending on the charge and whether it is to be reformed or desulfurized.

Due to the relatively small size of the reactors, it has been possible to reduce the thermocouple installation to eight per reactor. Operation is the conventional Cycloversion cycle of from 24 to 60 hours on stream, followed by a regeneration period. A small 1102 MBtu. per hour gas-fired steam superheater provides the heat and diluent for the regeneration air supplied at 212 cfm.

Reactor effluent after passing through the charge-to-product exchanger, enters the fractionator, its temperature having dropped to about 470° F in preheating furnace charge to the reactor.

The old crude unit fractionator received an extensive working over, as it was equipped with 31 trays plus three stripping sections, dimensions being 5 by 96 ft. It was entirely too tall for the new processing duty, which called for a 5-ft. diameter tower with 20 trays on 24-in. spacing.

Rather than cut out a section and reweld the head in place, the feed transfer line was introduced into the

TABLE 1—Perco Catalytic* Reforming and Desulfurization of Refinery Stocks

	Reforming of Straight-Run Naphtha		Desulfurization of Thermally Cracked Gasoline		Desulfurization of Cracked and S. R. Gasoline Blend**	
	Charge	Product	Charge	Product	Charge	Product
Operating Conditions:						
Space velocity, vol./vol./hr.	0.57		0.49		0.49	
Catalyst case inlet Temp., °F	950		730		804	
Catalyst case pressure, psig.	28		32		33	
Laboratory Inspection:						
Gravity, °API @ 60° F	70.9	67.1	58.9	57.0	....	65.0
API Distillation, °F						
IBP	90	92	86	90	90	92
10%	123	120	124	125	125	127
50%	216	222	265	262	234	240
90%	290	296	358	344	330	350
EP	346	350	394	386	383	396
Reid vapor pressure, psig.	10.0	10.0	10.0	10.0	10.0	10.0
Lamp Sulfur, wt.-%	....	....	0.408	0.26	0.187	0.076
Mercaptan Sulfur, wt.-%	....	....	0.067	0.005	0.024	0.001
Research Octane Rating:						
Clean	50.1	61.2	71.8	80.7	62.9	68.5
Plus 3 ml. TEL/gal.	76.9	84.6	80.0	89.8	76.8	82.8

* "Cyclocel" grade Bauxite Catalyst (Perco)
** 65% cracked; 35% straight run.

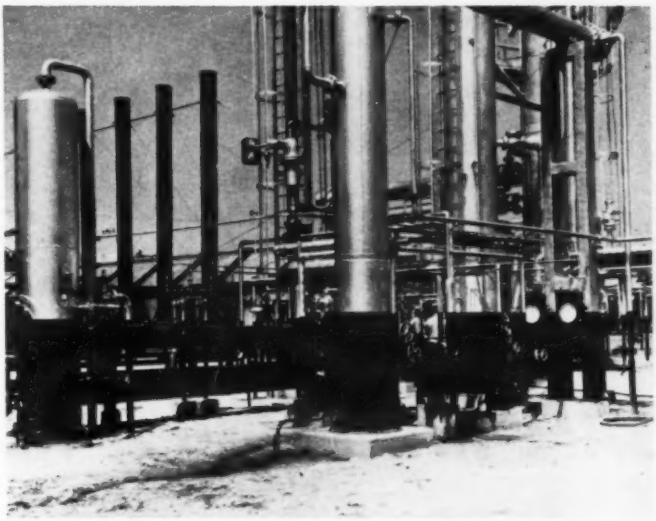
center of the column to give desired fractionation during the upward travel of the vapors. Caps were removed from all stripping trays and sidecut openings blinded off. A blind tray was installed near the bottom, provided with a 6-in. O. D. overflow line leading to the actual tower bottom. Liquid level on this tray is maintained sufficiently high to provide supply and surge capacity for the pump feeding the fired reboiler circuit. The reservoir thus created in the bottom also acts as bottoms product surge tank, the effluent being pressured to heavy polymer storage.

An interesting feature about the unit at this point involves the polymer bottoms from the Perco fractionator, which are used in thermal cracker feed stock. The initial charge preheat is obtained conventionally by exchanging cold feed against poly reactor effluent. The second exchanger on this feed stream, through which a portion of the Perco polymer stream to the reboiler may be diverted, supplies the balance of charge preheat needed. During routine operation this method has proved very satisfactory.

Returning to the fractionator overhead, gases from the overhead accumulator join overhead gases from the thermal cracker separator (not shown in the flow sheet) to a scrubber and compressor to a conventional Raschig-ring packed absorber having a sponge-oil section in the top. Fractionator accumulator liquids are debutanized in a column having a fired reboiler, the debutanized gasoline furnishing charge preheat to this column, then going to finished storage. A portion of the debutanized gasoline is used as absorption oil to the absorber. Absorber bottoms commingle with Perco gasoline to debutanizer.

There is considerable hydrogen sulfide and mercaptan sulfur present in the debutanizer overhead, especially when the thermal cracker is in operation, whereas no more than 40 grains per 100 cu. ft. can be tolerated in the poly charge. This necessitates a conventional diethanolamine system followed with caustic and water washing. Not to confuse the reader, the flow sheet correctly indicates that, in the original installation, caustic and water were not to be circulated through the respective towers, depending instead on batchwise washing with strong (40Be) caustic and water. Subsequently, Lacy has set pumps and circulates both caustic and water over the towers.

The U.O.P. poly unit has a design capacity of 72 b/d of 10-lb. RVP gasoline and consists of a single three-bed reactor containing 3640 lbs. of catalyst. Operating at 490 psig in vapor phase, the usual inter-bed quench with propane is employed, along with sufficient water to prevent catalyst dehydration. Water is metered into the charge stream and between the two beds by a Hills-McCanna reciprocating pump taking suction on three individual metering pots supplied with steam condensate.



GAS RECOVERY SECTION of revamped plant, showing compressor suction scrubber, absorber, and Perco gasoline debutanizer

Polymer make is successively depropanized and stabilized, the propane being charged back for interbed cooling in the reactor and as charge recycle. Excess is used as plant fuel. The stabilizer is designed to produce 78 b/d of butane overhead. This is slightly more than the polymer make and is utilized in gasoline blending.

Plant Performance

The initial start-up of the unit was made on a straight-run naphtha charge, operating at reforming conditions. Subsequently, runs have been made with thermally cracked gasoline and a blend of cracked and straight-run. For the most part the plant has continued to operate on the blend, as this does not require the storage facilities necessary under blocked operations. However, in processing on a straight-through basis from crude topping to finished product, the Perco unit capacity is effectively reduced to 1120 b/d, since currently there are only 720 b/d of straight-run and 400 b/d of thermally cracked stocks available.

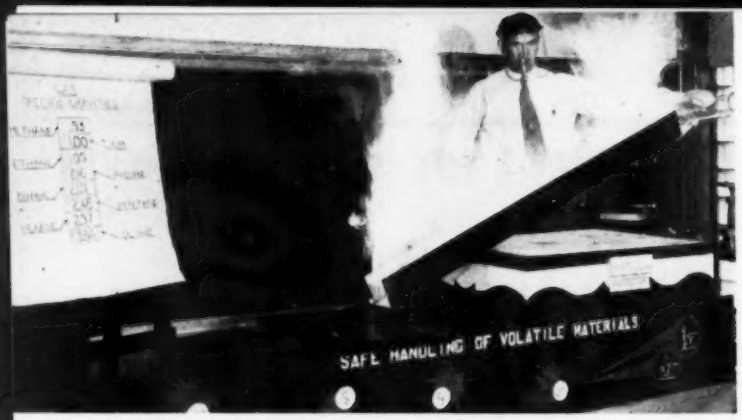
Plant data for the three types of operation are shown in Table I. It will be noted that a ten-point increase was obtained in the clear octane rating of the naphtha under reforming conditions, while the leaded rating increased slightly less. The material now will meet "regular" grade gasoline specifications without further blending; formerly it would not.

Similarly, by removing substantially all of the mercaptan sulfur and more than half the lamp sulfur from the quite sour cracked feed the stock now will make "premium" grade gasoline; formerly it met "regular" grade specifications with the same amount of lead.

In another run, data not reported here, the plant processed a cracked gasoline under reforming conditions of 920° F. catalyst case inlet temperature. The leaded octane rating was 90 Research without blending in any polymer gasoline.

Operating on the blend of cracked and straight-run gasolines, the plant is readily able to produce "regular" gasoline without blending with poly gasoline, even when operating under desulfurizing conditions only. More than half the lamp sulfur has been removed and mercaptan sulfur is negligible. An increase of 5.6 octane numbers is shown for the clear gasoline, six points with 3 ml. TEL, in the data presented. In other runs this increase has been seven or more numbers.

When processing the combined feed, a temperature between that of desulfurization and reforming is maintained. Under these conditions, the straight-run portion of the feed is desulfurized only, while the cracked stock is both desulfurized and to some extent reformed. Temperatures nearer reforming conditions result in increased gas formation, due to the decomposition of the cracked component of the feed.



PROTECTION of personnel and equipment handling volatile hydrocarbons in the refinery is the primary aim of a new training program set up by Esso Standard Oil Co. on the . . .

SAFE HANDLING of Volatile Materials

COMBINING cold hard facts and dramatic visual demonstrations, Esso Standard Oil Co. has worked out a new training program aimed at teaching its refinery personnel how to work with volatile hydrocarbons safely.

The new training program seeks to provide all personnel associated with the processing, storing and so on of light hydrocarbons in Esso's manufacturing units with background information regarding:

1) The characteristics of the hydrocarbon materials being handled,

2) The operations involved in handling them and

3) An appreciation of the knowledge and skills necessary to carry on these operations safely.

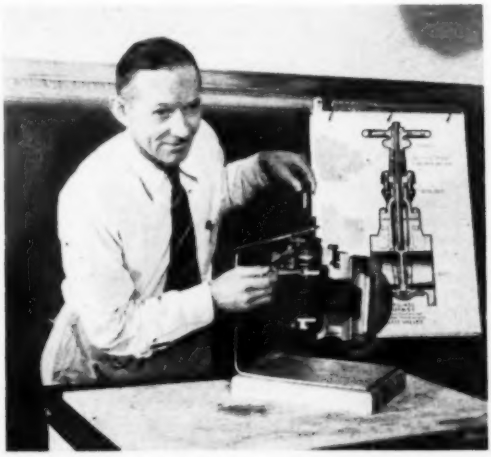
It is aimed specifically toward improving immediate job performance as a means of insuring safety for both personnel and equipment.

The new program was recently launched at Esso's Baltimore refinery, and is soon to get under way in Esso's other East Coast plants.

Initially, training is to be given to all personnel immediately engaged in the manufacture and handling of volatile materials; later, short refresher courses may be given. The instruction is given at company expense, with classes scheduled to fit in with employees' work schedules. Personnel selections are made without respect to job classification or unit job service. Instructors are all drawn from refinery personnel.

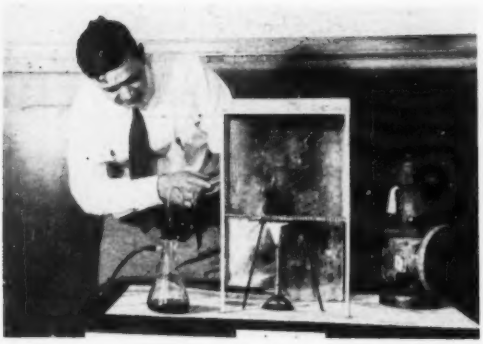
Visual demonstrations, aimed at impressing otherwise dry facts on the "student's" mind, highlight the course.

One such demonstration is that pic-

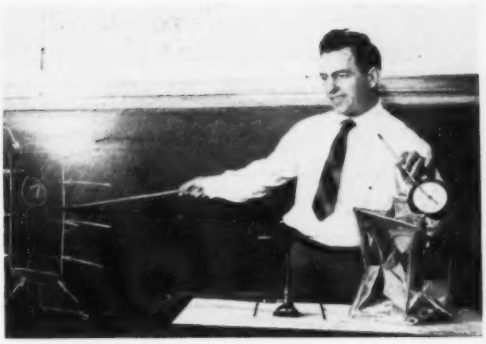


VALVES—Operating principles, maintenance, and importance of lubrication are shown with special cutaway pieces of equipment

COMBUSTION—Heat, fuel and air are elements required for fire. This is demonstrated when a spark (heat) ignites a mixture of hydrocarbon vapor and air



EXPLOSION—Flask on bunsen burner represents a closed vessel. Heat generates pressure, which drives out stopper, showing how equipment not protected with safety valves could be destroyed



COLLAPSE—This could happen to a tank, tower or other pressure vessel after gas-freeing with steam, if not properly vented. In experiment, can is steam, then tightly capped and allowed to cool. External pressure does the rest

tured above, developed to show that butane gas is heavier than air, invisible and inflammable. In this particular experiment the instructor holds before him a corked flask, apparently empty. He assures his class, however, that it contains butane gas. In front of him on the demonstration table is an inclined metal chute, at the base of which is a tiny flame.

He explains that the butane will flow down the chute and into the flame, as proof that the gas is heavier than air. He then removes the cork and "pours" the gas onto the chute. In a matter of seconds there is a flash at the point of ignition and a flame runs up the chute to the source of the gas.

Although the demonstration is theatrical it has its practical application. The flask is likened to a leaking butane tank, with the gas creeping along the ground, into ditches and culverts, always seeking a lower level. The men are impressed with the importance of proper maintenance of equipment and the avoidance of points of ignition in critical areas.

Other demonstrations, illustrated at the bottom of this article, show the effects of pressure, and the elements necessary for combustion.

Besides demonstrations such as that with butane gas, visual aids are used liberally throughout the course in the form of charts, slide films, sectional views of actual equipment and blackboard sketches.

The course outline consists of six major subjects: General information concerning light hydrocarbon gases and liquids; general operating principles of equipment and facilities; safety and emergency facilities; processing startup and shutdown procedures; sampling equipment and procedures; and safety equipment and its use.

Considerable variety in methods of presentation in the respective classes adds to the interest. Some instructors handle their subjects on the straight lecture basis. Others use the conference technique, calling for questions and answers between instructor and class members.

While all phases of the course have the dramatic impact of the demonstrations, they are nevertheless crammed with information covering construction and functions of valves, packings, pumps and other adjuncts to efficient and safe operation of equipment.

BOMBS—Actual equipment, such as this typical liquid sample bomb, is used wherever possible to illustrate points brought up in the discussion

GAGES—Pertinent parts of typical pressure gages are explained. Here instructor is pointing to Bourden tube which operates indicator

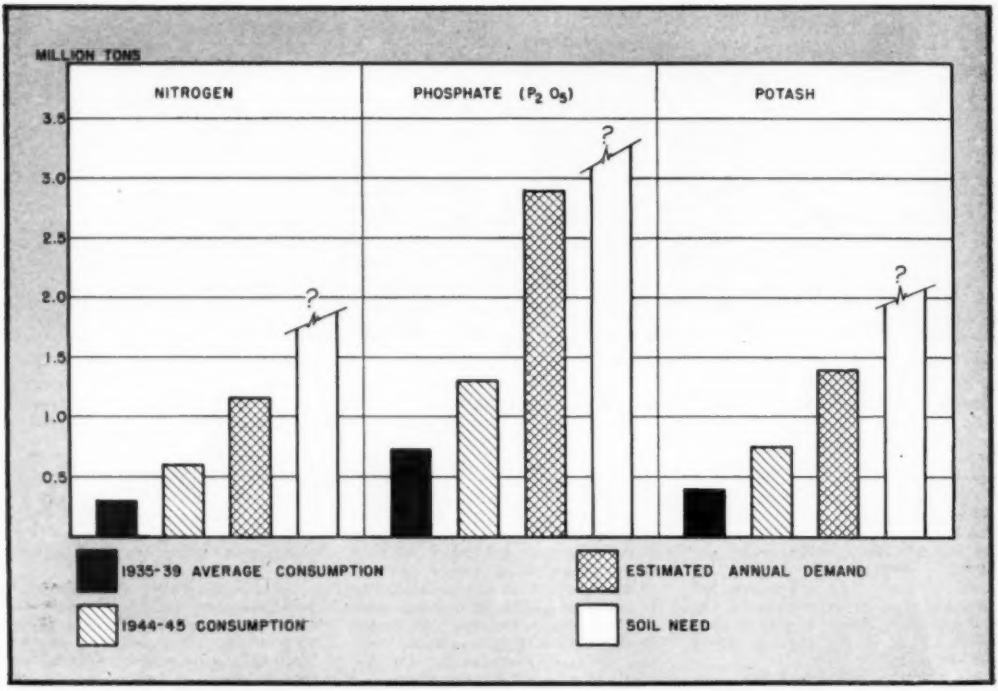


FIG. 1—Fertilizer consumption and estimated need in the United States

Fertilizer from Petroleum

By G. W. McCULLOUGH, C. W. PERRY and R. S. OGILVIE*
Phillips Petroleum Co., Bartlesville, Okla.

The increasing importance of petroleum hydrocarbons in the fixation of atmospheric nitrogen for fertilizer is emphasized. The nitrogen fertilizer program of Phillips Chemical Co. is described, including the geographic location of plants and facilities. The intermediate pressure process is used for manufacturing synthetic anhydrous ammonia from natural gas. Part of this ammonia is converted to nitric acid. Nitric acid and anhydrous ammonia are converted to ammonium nitrate fertilizer in "prill" form for convenient handling. The company also operates a large plant for manufacturing ammonium sulfate from anhydrous ammonia and sulfuric acid. Brief mention is made of the importance of sulfur recovery (from petroleum to manufacture sulfuric acid) to make ammonium sulfate fertilizer. Urea is mentioned as another nitrogen compound showing promise as a nitrogenous fertilizer.

THE role of carbon and hydrogen from petroleum hydrocarbons in fixing atmospheric nitrogen for fertilizer purposes is of ever increasing importance. This is illustrated by the fact that less than 5% of the U. S. synthetic ammonia was manufactured from natural gas in 1940, whereas in 1950 it will be roughly 45%. Out of about 1,875,000 tons of synthetic ammonia expected to be made in 1950, 834,000 tons will derive its hydrogen from petroleum sources. Carbon from petroleum hydrocarbons is also commencing to find its way into urea by reaction of waste carbon dioxide from natural gas (at ammonia plants) with ammonia which already contains the hydrocarbon hydrogen. Sulfur from petroleum is becoming increasingly important as a raw material for sulfuric acid to make ammonium sulfate fertilizer.

Before examining the chemical engineering processes for making these nitrogen products, it is worthwhile to take a brief glance at the overall fertilizer picture.

An undeniable axiom is that as world population increases and soil fertility decreases, increasing quantities of fertilizer materials must be used. Growing of crops depletes soil of elemental phosphorus, nitrogen and potassium in large and measurable amounts each year, and to a lesser extent trace quantities of copper, manganese and other elements are removed. These must be replaced. Nitrogen may be replaced by

* Presented at the Houston Regional Meeting of the American Chemical Society, March, 1950.

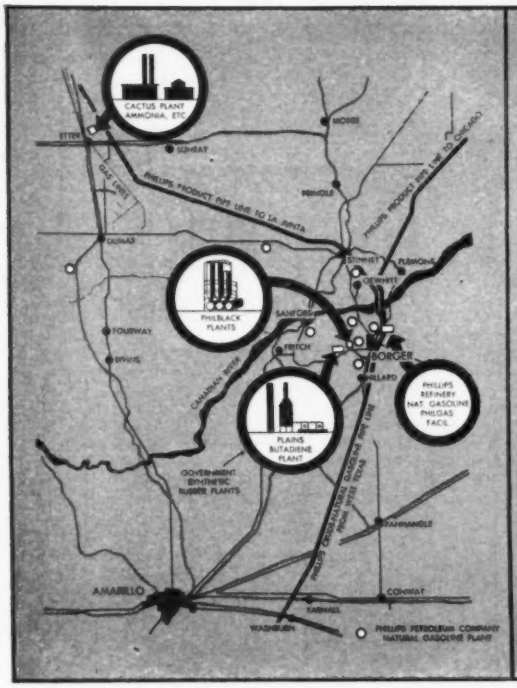


FIG. 2—Geographical relationship of Panhandle area plants

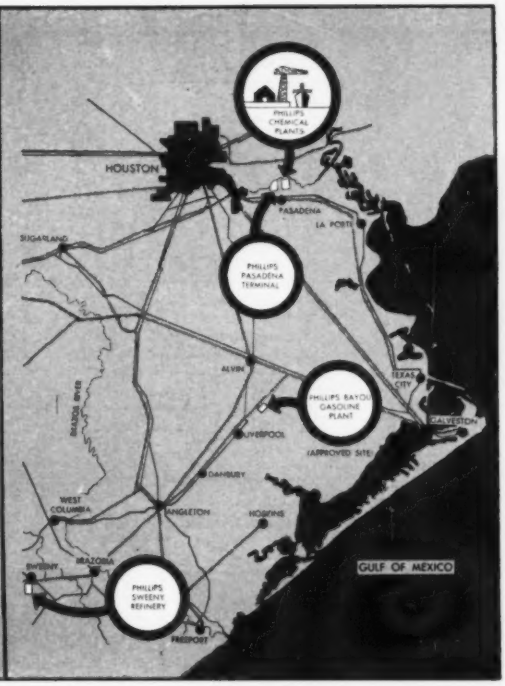


FIG. 3—Geographical relationships of Houston-Gulf Coast plants

natural or artificial means; i.e., either by growing legume-type crops periodically, applying animal manures, or applying chemical-type fertilizers. Petroleum hydrocarbons aid mainly in fixing atmospheric nitrogen for chemical-type fertilizers of this class. To an increasing extent, ammonia and phosphorus from phosphate ores are being combined chemically to give ammonium phosphates which supply 2 of the 3 major elemental requirements.

Farmers of this country, since the outbreak of World War II, have relied more heavily on chemical fertilizers. This is shown graphically in Fig. 1.(1) U. S. usage of the 3 basic fertilizer types is still only about half of what could be profitably used. This is an improvement over 1936, however, resulting partly from the damage to industrial plants in Europe, and partly from the increased manufacture of all 3 types of fertilizer in the U. S. Table 1 shows the relative status of U. S. usage compared to several European countries in 1936.(2)

Data are available to show that an increase in total fertilizer consumption in the U. S. of about 45% has taken place between 1936 and 1945. This applies to nitrogen, phosphate, and potash materials, and is about equal for all three. As shown in Fig. 1, the 1944-45 consumption of nitrogen fertilizer was only about 50% of the estimated annual demand, and a smaller fraction of the real soil need.

Sources of Fertilizer Nitrogen

Prior to the availability of chemical fertilizers, nitrogen was applied to the soil in this country in animal manures which usually had nitrogen contents of 3% or less. An exception

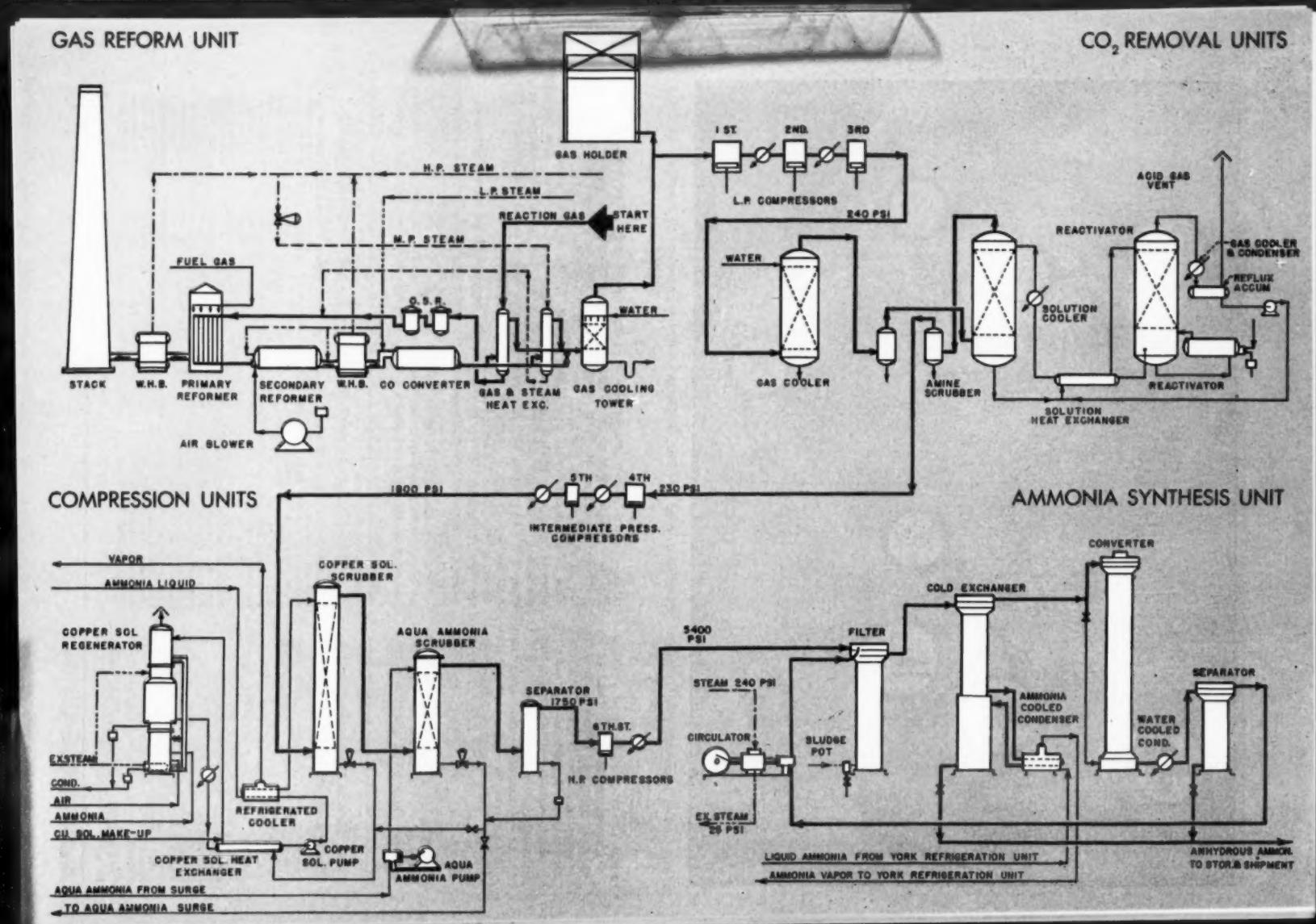
TABLE 1—1936 Consumption* of Fertilizers (All Types) for Several Countries

Country	Cons.
Holland	106
Belgium	84
Germany	57
Denmark	37
Norway	22
Spain	20
France	18
Switzerland	17
Sweden	15
Great Britain	14
Italy	13
Czechoslovakia	10
Austria	6
Greece	5
United States	4
Poland	2
Hungary	1

* In pounds per acre to crop and pasture lands.

TABLE 2—Estimated Present Production of Synthetic Ammonia In the U.S.

Company or Plant	Location	Est. Capacity Tons Ammonia Per Year	Source of Hydrogen
Allied Chemical & Dye Corp.	Hopewell, Va.	252,000	Water Gas
Allied Chemical & Dye Corp.	South Point, Ohio	170,000	Water Gas
E. I. duPont Co.	Belle, West Va.	205,000	Water Gas
E. I. duPont Co.	Niagara Falls, N. Y.	13,400	Electrolysis
Shell Chemical Co.	Pittsburg, Calif.	100,000	Petroleum
Hercules Powder Co.	Pinole, Calif.	15,800	Petroleum
Dow Chemical Co.	Midland, Mich.	13,400	Water Gas
Dow Chemical Co.	Pittsburg, Calif.	3,600	Electrolysis
Mathieson Chemical Co.	Niagara Falls, N. Y.	6,000	Electrolysis
Mathieson Chemical Co.	Lake Charles, La.	69,000	Petroleum
Penn Salt Manufacturing Co.	Wyandotte, Mich.	11,000	Electrolysis
Spencer Chemical Co.	Pittsburg, Kans.	155,000	Petroleum
Lion Oil Co.	El Dorado, Ark.	200,000	Petroleum
Commercial Solvents Corp.	Sterlington, La.	69,000	Petroleum
Phillips Chemical Co.	Etter, Texas	140,000	Petroleum
Tenn. Valley Authority	Muscle Shoals, Ala.	67,000	Water Gas
Morgantown Ordnance Works	Morgantown, West Va.	230,000	Water Gas
Ohio River Ordnance Works	West Henderson, Ky.	60,000	Water Gas
San Jacinto Ordnance Works	Houston, Texas	24,000	Petroleum
	Total	1,806,200	


GAS REFORM UNIT
CO_2 REMOVAL UNITS
GAS HOLDER
H.P. STEAM
L.P. STEAM
M.P. STEAM
REACTION GAS
START HERE
FUEL GAS
O.S.R.
WATER
STACK
W.H.B.
PRIMARY REFORMER
SECONDARY REFORMER
W.H.B.
CO CONVERTER
GAS & STEAM HEAT EXC.
GAS COOLING TOWER
AIR BLOWER
1 ST.
2ND.
3RD
L.P. COMPRESSORS
240 PSI
WATER
GAS COOLER
AMINE SCRUBBER
SOLUTION COOLER
REACTIVATOR
ACID GAS VENT
GAS COOLER & CONDENSER
REFLUX ACCUM
REACTIVATOR
SOLUTION HEAT EXCHANGER
COMPRESSION UNITS
1800 PSI
5TH
4TH
230 PSI
INTERMEDIATE PRESS. COMPRESSORS
AMMONIA SYNTHESIS UNIT
VAPOR
AMMONIA LIQUID
COPPER SOL. SCRUBBER
COPPER SOL REGENERATOR
AQUA AMMONIA SCRUBBER
SEPARATOR 1750 PSI
6TH ST.
H.P. COMPRESSORS
5400 PSI
FILTER
COLD EXCHANGER
CONVERTER
STEAM 240 PSI
CIRCULATOR
SLUDGE POT
AMMONIA COOLED CONDENSER
WATER COOLED COND.
SEPARATOR
EX STEAM
COND.
AIR
AMMONIA
CU SOL. MAKE-UP
REFRIGERATED COOLER
COPPER SOL. HEAT EXCHANGER
COPPER SOL. PUMP
AQUA AMMONIA PUMP
EX. STEAM 29 PSI
AQUA AMMONIA FROM SURGE
TO AQUA AMMONIA SURGE
LIQUID AMMONIA FROM YORK REFRIGERATION UNIT
AMMONIA VAPOR TO YORK REFRIGERATION UNIT
ANHYDROUS AMMON. TO STOR.& SHIPMENT

was refined Chilean nitrate from "guano", which theoretically would have 19% nitrogen. At this time, other than natural sources of nitrogen, synthetic ammonia is the source of 87% of chemical fertilizer nitrogen. The name and location of the principal synthetic ammonia producers in this country is shown in Table 2, with the source of hydrogen.

Other sources of fertilizer nitrogen in the U. S. are byproducts from chemical processes, estimated to be 165,000 tons annually, and organic nitrogen compounds estimated at 30,000 tons annually.

Phillips Nitrogen Program

Phillips Chemical Co., a wholly-owned subsidiary of Phillips Petroleum Co., became a major producer of fertilizer nitrogen by leasing and taking over the operation of Cactus Ordnance Works, in August, 1948. This is an intermediate pressure synthetic ammonia plant using natural gas as a source of hydrogen. The design is frequently referred to as N.E.C. (Nitrogen Engineering Corp.). The plant is located at Etter, Texas, 60 miles north of Amarillo, in an area in which Phillips Petroleum Co. operates large facilities for producing and refining crude oil, natural gasoline, natural gas, carbon black and butadiene. The relationship of these plants geographically and their dependence on connecting pipelines is shown in Fig. 2. Plains butadiene plant is one of the largest in the government program and is still operating. It has a rated capacity of 57,000 tons per year, using normal butane as raw material. Also at Etter are located the nitric acid and ammonium nitrate plants which are just coming into operation in November, 1949, to complete temporarily Phillips' nitrogen program in that area.

Phillips Chemical Co. also erected and is operating one of the largest ammonium sulfate plants in this country, at Pasadena, Texas, a suburb of Houston. Again in this area Phillips Petroleum, Phillips Chemical, and the latter's subsidiary, Phillips Terminal Co. operate integrated facilities as shown in Fig. 3. The opportunities for petrochemical expansion in the two areas described are very large.

Synthetic Ammonia

Fig. 4 gives in outline form the process flow for the N.E.C. ammonia plant at Etter. Raw natural gas coming into the plant has an approximate composition as given in Table 3. This gas contains a relatively high percentage of nitrogen as it is taken from the ground. This is fortunate for an ammonia process, but unfortunate for fuel usage. The hydrogen sulfide is almost completely removed by monoethanolamine scrubbing, in the conventional way, from that portion of the gas used in the process itself and as fuel for gas engine compressors, which is about 50% of the total. The rest is used as boiler and reforming furnace fuel as it arrives at the plant. Roughly 100,000 cu. ft. of this gas are required for one ton of ammonia.

FIG. 4 (Left) -- Anhydrous ammonia from natural gas

Starting at the beginning of the flowsheet, organic sulfur is removed by zinc oxide catalyst, after preheating by heat exchange to about 750° F. Steam preheated in a similar manner is now mixed with the reaction gas in a weight ratio of about 1 to 1 and the mixture passes down through the stainless steel tubes of the primary reform furnaces which contain reduced nickel oxide in pelleted form. The gas reforming reactions are mainly:

$$CH_4 + H_2O \rightleftarrows CO + 3H_2$$
$$CH_4 + H_2O \rightleftarrows CO_2 + 4H_2$$

To a small extent the following reaction also takes place, requiring a periodic catalyst steaming:

$$CH_4 \rightleftarrows C + 2H_2$$

The main reforming reactions are endothermic, requiring heat transfer from hot combustion gases through the tube walls. The gas is reformed at approximately 1300° F.

In order to clean up residual methane, and at the same time introduce air containing the required amount of nitrogen, the effluent then passes to secondary reformers containing the same type of reduced nickel oxide catalyst. Due to combustion of part of the gases from primary reforming, the oxygen in the air is consumed, and the temperature rises to about 1830° F. At the Cactus plant, the secondary reformers are brick-lined horizontal cylindrical vessels, with the catalyst supported on grids.

After passing through waste heat boilers, to reduce the temperature to 950° F. and recover heat, the gases next pass through CO converters, where the water gas shift reaction takes place: (Additional steam is added.)

$$CO + H_2O \rightleftarrows CO_2 + H_2$$

The reformed gas is now quenched to atmospheric temperature by direct spray water coolers. An approximate composition of the reformed gas, which is stored in a gas holder, is as follows:

Component	Mol %
Hydrogen	60.0
Nitrogen	20.0
Methane + Inerts	.2
Carbon Monoxide	2.5
Carbon Dioxide	16.3

Compression and Gas Purification

In the process used at Cactus, the reformed gas is drawn from the gas-

Meet the Authors

Dr. Perry

Mr. Ogilvie

Mr. McCullough

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C. W. Perry is process consultant with Phillips Chemical Co. He holds an M. S. in Chemical Engineering from M. I. T., 1935, and received an engineering doctorate in Chemical Engineering from Johns Hopkins in 1940. Dr. Perry is an active member of both the American Chemical Society and the American Society of Chemical Engineers. He is a registered professional engineer in Maryland. **R. S. Ogilvie** is chief process engineer and chemist at Phillips Chemical Co.'s Cactus plant at Dumas, Texas. He is a 1937 graduate of the University of Colorado with a B. S. in Chemical Engineering.

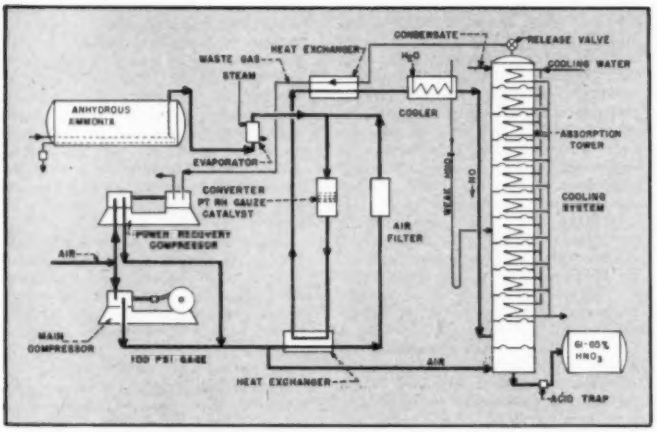

FIG. 5—Flow diagram: nitric acid by oxidation of ammonia

holder by gas engine-driven compressors and compressed in 3 stages to about 250 psig. At this pressure it is passed through absorbers (packed towers) countercurrent to aqueous monoethanolamine solution for carbon dioxide absorption. The process gas is thus reduced to about 0.5% CO_2. The amine solution is regenerated by heating at low pressure, and substantially pure CO_2 is vented.

The process gas next passes to 2 additional stages of compression to elevate the pressure to 1800 psig. At this pressure it flows through packed tower scrubbers countercurrent to a cold (32° F.) aqueous ammoniacal solution of copper ammonium formate to absorb carbon monoxide. Removal of CO is substantially complete. The copper ammonium formate is regenerated by reducing the pressure, heating and blowing with air to oxidize part of the reduced copper back to the cupric form. Part of the residual CO_2 is also absorbed in these scrubbers by aqueous ammonia, forming ammonium carbonate. The rest of the CO_2 is absorbed in aqueous ammonia in a separate scrubber following the copper scrubbers. The process gas now contains, other than nitrogen and hydrogen, only the contaminants methane, argon, and other inerts.

After a 6th stage of compression to 5000 psig., the process gas is blended with recirculated unconverted gas containing part of the ammonia synthesized and passed through heat exchangers for precooling, and final deep cooling to remove the remaining ammonia yielded in the last pass of the recirculated gas through the converters. The blended gas then goes to the combined converter-heat exchangers, where synthesis of ammonia over promoted iron catalyst takes place at about 930° F. The heat exchangers, which are integral with the converters, preheat the incoming gas by exchange with hot outgoing gases. The granular iron catalyst is contained in tubular "baskets".

Under these conditions the conversion per pass is about 12% and the overall hydrogen efficiency is about 85%. A voluntary purge is required on the gas entering the converters, in order to keep methane, argon and other inerts down to a low percentage. This reduces the efficiency of the process.

The greater part of the ammonia produced per pass over the synthetic catalyst is condensed out at 5000 psig. by water-cooled condensers. This, together with the remainder of the ammonia, consensed out in the indirect, ammonia-cooled condensers, is removed from the process in lower pressure letdown tanks as liquid. It flows to the lower pressure storage spheres, which are refrigerated by taking ammonia vapor from the top of the liquid and then compressing and condensing it back to liquid ammonia. Non-condensible gases are purged from this compression system. From the spheres, liquid ammonia may be pumped to tank cars or other uses.

Chemical Engineering Problems

It is worthwhile to consider briefly some of the chemical engineering problems which still exist with the intermediate pressure ammonia process. This process has been operated commercially in this country for at least 25 years. There is always the desire for more active catalysts, to give closer approach to equilibrium under operating conditions. There are 4 main catalytic steps in this ammonia process, and all can be improved.

The process is largely hand controlled, partly because of the unavailability of automatic devices which will function properly at the high pressure encountered. Controlling infra-red spectrometers are only commencing to be used. The mechanical design of the converters results in high maintenance, and there appears to be an opportunity for improvement here.

The addition of nitrogen by air injection is wasteful of hydrogen in reformed gas, although part of it is recovered through the water gas shift reaction. There are alternate methods for introducing nitrogen into the process. These are just a few of the more prominent chemical engineering problems to be solved in the manufacture of ammonia from natural gas.

Table 3—Composition of Natural Gas for Ammonia Plant

Constituent	Mol %
Methane	72.0
Ethane	6.2
Propane	4.0
Butanes	1.8
Pentanes & Heavier	0.8
Hydrogen Sulfide	0.1
Nitrogen	15.0

Nitric Acid

In the manufacture of ammonium nitrate fertilizers from ammonia it is necessary to have a source of nitric acid with which to convert the anhydrous ammonia into the nitrate form. Where ammonia is available, nitric acid is manufactured by direct air oxidation of ammonia to form nitrogen dioxide. The nitrogen dioxide is then absorbed in pure water, usually steam condensate, to form a nitric acid solution of about 60% concentration. Phillips Chemical Co. produces ammonia at its Cactus Plant; so it manufactures nitric acid by the ammonia oxidation process which is illustrated in Fig. 5. The following chemical reactions take place in the production of nitric acid by the ammonia oxidation process.

(1) $4NH_3 + 5O_2 \rightleftarrows 4NO + 6H_2O$

(2) $2NO + O_2 \rightleftarrows 2NO_2$

(3) $3NO_2 + H_2O \rightleftarrows 2HNO_3 + NO$

In the ammonia oxidation process the combustion air is furnished at 100 psi by two sets of air compressors. The *primary* air compressors are driven by 700 hp synchronous motors. These units, as was most of the equipment, have been transferred from Army Ordnance Plants located in the Eastern states, where electric power was readily available. If new compressors had been bought, it is quite likely that for a Texas Panhandle location, gas engine driven units would have been selected.

The secondary, or power recovery compressors, supply about 40% of the process air requirements. These compressors are driven by reciprocating

expansion engines which employ the exhaust or tail gas from the absorbers as a source of power.

The process air at 100 psi. is preheated by heat exchange with the hot reaction gases from the ammonia oxidation unit. The filtered hot air then mixes with the gaseous ammonia stream in a ratio of about 90% air and 10% ammonia by volume. An automatic ratio controller will measure and maintain the proper ratio of ammonia to air in this plant.

Ammonia is supplied to the process from a series of high pressure storage tanks. They are equipped with heating coils and automatic temperature controls which will maintain sufficient pressure in the tanks to make possible the elimination of ammonia pumps. Liquid ammonia flows from the storage tanks into the evaporator, where the ammonia is gasified before being mixed with the air.

The mixture of ammonia and air flows to the converter, where it passes over a platinum-rhodium catalyst at a temperature of about 1697° F. At this point the ammonia is oxidized to a mixture of nitrogen oxides consisting mainly of nitric oxide. Very close temperature control is required to prevent overheating and severe damage to the catalyst.

After the converter, the hot reaction gases flow through two heat exchangers. The first serves to preheat incoming process air, and the second heats the tail gas going to the power recovery engines. The reaction gases then pass through a water cooled heat exchanger, which reduces the gas temperature to near atmospheric conditions. Some water condenses in this cooling step, and a dilute nitric acid is formed. This dilute acid is separated from the gas stream, and injected into the absorption tower at a point where the acid strength is comparable.

The cooled gases consisting of nitrogen oxides, nitrogen, water vapor, and small quantities of oxygen, flow from the cooler directly into the absorption column. Some additional air is injected at this point to complete the oxidation of nitrogen oxides to nitrogen dioxide.

The absorption column contains 20 trays of the bubble cap type. Cooling coils are provided on the trays, in order to remove the heat of reaction or solution so that the maximum acid strength may be produced. Higher temperatures reduce the solubility of the nitric oxides.

Cooled steam condensate is supplied to the top of the absorption column, and flows downward where it meets the upflowing gases. The nitrogen oxides are absorbed to form a water solution of nitric acid, which is removed to storage from the bottom of the absorber. This acid is warmed and is blown with air to bleach it. The presence of nitrogen tetroxide causes a greenish colored acid, and this condition is corrected by the warming and air blowing treatment.

The tail or exhaust gases from the absorption tower at about 85 psi. flow back through the heat exchanger, and are reduced to atmospheric pressure through the power recovery engines.

The manufacture of nitric acid by this process is not new, but there are many ways in which the process might be improved. The most important improvement would probably be the development of a cheaper catalyst. The catalyst costs in the existing process are greater than the total labor costs.

The use of automatic controls is another matter which will require attention in the future. It is planned to employ automatic controls in several new applications in this plant.

Proper materials of construction are also important, for nitric acid, in the concentrations encountered, is very corrosive. Stainless steels of type 316 and 347, or high chrome iron are very satisfactory in nitric acid service. For gaskets it is advisable to use blue African asbestos in hot service, and teflon is recommended for gaskets or packing in cold service.

Ammonium Nitrate

Ammonia and nitric acid are important chemicals, but as such are of little value as fertilizers. Anhydrous ammonia has and is being applied as a nitrogen fertilizer, but the quantities used in this way are relatively small. In order to sell ammonia in the fertilizer industry, it is necessary to convert it to a form which is easily handled and which makes the nitrogen content readily available as plant food. Ammonium nitrate is one of the more popular nitrogen fertilizers; and it is produced by reacting ammonia with nitric acid according to the reaction.

$$NH_3 + HNO_3 \xrightarrow{H_2O} NH_4NO_3$$

This reaction is carried on in the presence of water, part of which evaporates to remove the heat of reaction. The nitric acid used as mentioned before, is a water solution containing roughly 40% water. This supplies more than adequate water to control the temperature of the nitrating reaction.

Solid ammonium nitrate is being manufactured mainly for 3 processes: (1) graining, (2) vacuum crystallization, and (3) prilling. The graining process is old, and was employed at Army Ordnance Plants during the war to produce solid ammonium nitrate as a constituent used in bomb and shell loading. As many of you know, ammonium nitrate is used extensively in the manufacture of explosives. By itself, however, ammonium nitrate is not considered as an explosive. It thus serves in a dual role as a fertilizer during peace time. It is important to remember that these nitrogen fertilizer plants can be converted into valuable wartime operations at a moment's notice.

Some solid ammonium nitrate is now being produced at T.V.A. by the vacuum crystallization process. This method produces a material which is more readily handled than that made by the graining, or open pan crystallization method.

The third and most popular method is the prilling process, which was developed in Canada and is being widely adopted in the U. S. The new plant being erected by Phillips will employ this process. It produces a solid spherical particle which lends itself to easy handling and is, therefore, popular with the consumer.

Another form of nitrogenous fertilizer is becoming popular, commonly called "nitrogen solution". This material consists of a mixture of ammonium nitrate, ammonia and water. It is prepared by mixing or dissolving anhydrous ammonia into an ammonium nitrate solution. Various ratios of ammonia to nitrate are employed to meet the customer's demands.

Perhaps the manufacture of ammonium nitrate and nitrogen solutions can best be explained by reviewing the flow sheet (Fig. 6). Ammonia and nitric acid of about 60% concentration are thoroughly mixed and neutralized.

Considerable heat results from the reaction of ammonia and nitric acid, which is removed by the evaporation of water. The water is introduced with the nitric acid feed stream. From the foregoing, it is apparent that the neutralization reaction takes place at the boiling temperature of the nitrate solutions in the neutralizer.

For solid ammonium nitrate, the solution of 75 to 80% concentration from the neutralizer flows directly into the concentrator, which is nothing more than a single-stage evaporator. Heat is supplied to the concentrator by low pressure steam. An ammonium nitrate solution of 95% concentration is produced and pumped to the top of the prilling tower, where it is filtered and then sprayed in small droplets down through the tower. All pipe lines and vessels containing the 95% solution must be either steam traced or jacketed to prevent freezeups in the equipment. The 95% ammonium nitrate begins to solidify in a crystalline form at about 243° F.

In the prilling process, the hot concentrated ammonium nitrate so-

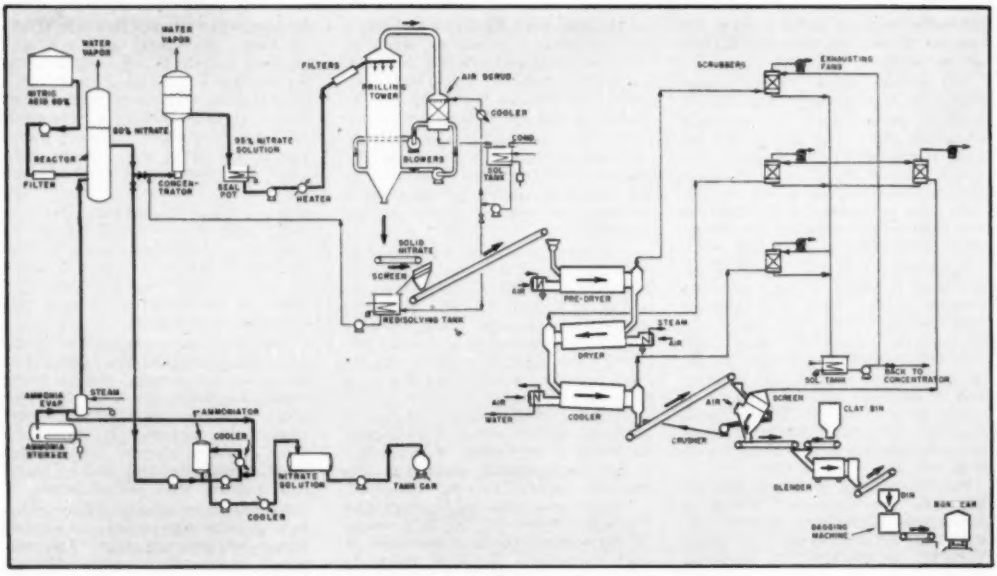

FIG. 6—Flow diagram: manufacture of ammonium nitrate

lution is sprayed as droplets down through the prilling tower. In falling, the droplets are cooled to below the solidification temperature by an upflowing, or countercurrent stream of cool air. In so cooling, each droplet forms a solid sphere of ammonium nitrate in much the same manner that lead shot are formed. The prilling tower has, therefore, at times been referred to as a shot tower.

Very little drying of the ammonium nitrate occurs in the prilling operations. The main function of the prilling tower is to cool the sprayed droplets to a temperature well below the solidification point.

The nitrate prills or pellets are gathered at the bottom of the tower onto a belt conveyor which feeds the material into a series of 3 rotary dryers. The first dryer serves as a preheater, as it is essential to control the rate of temperature rise of the pellets. A too-rapid rate of heat input will cause spalling or breakage of the pellets. The second dryer accomplishes about 75% of the total moisture removal, and the third unit serves as a cooler. A small amount of drying takes place in the cooler.

The dried product is screened, and blended or coated with diatomaceous earth before being bagged for shipment. Ammonium nitrate adsorbs moisture very readily at certain atmospheric conditions. The adsorption of moisture and subsequent redrying causes severe caking or cementing of the product during storage. This is a serious detriment to handling by the consumer and must be prevented insofar as possible. It has been found that a thin coating of diatomaceous earth on the nitrate particles is quite effective in preventing caking. The T.V.A. organization has done considerable work on this phase of ammonium nitrate handling.[3]

The solid ammonium nitrate will be bagged and shipped in multiwall paper bags. Ammonium nitrate is ordinarily packaged in 6-ply bags, two plies of which are made of an asphalt-laminated sheet of paper. These asphalt-laminated sheets add considerable resistance to moisture penetration of the bag during storage and handling.

As mentioned before, ammonium nitrate is also sold as nitrogen solutions when mixed with ammonia in specified ratios. In Phillips' plant, a continuous mixing process is being installed. The nitrate solution is pumped into the circulating stream of the ammoniator, where it is mixed with the desired quantity of liquid ammonia. The ammoniator consists of a closed vessel and a circulator pump. The rate of circulation inside the ammoniator is much larger than the rate of feed or production. Thus it is possible to continuously withdraw a finished product. A corrosion inhibitor is also added to the nitrogen solution to prevent excessive corrosion of steel tanks and tank cars. After mixing in the ammoniator, the nitrogen solution is cooled and pumped to storage tanks.

It is possible to produce nitrogen solutions which contain up to 40% nitrogen by weight which are suitable to the trade. Higher nitrogen contents are possible, but vapor pressures of the solutions, due to the presence of free ammonia, would be higher than desirable. As it is, the 40% nitrogen solutions will generate vapor pressure up to 15-20 psig. during warm weather if stored in unprotected tanks.

The chemical reaction to produce ammonium nitrate is quite simple. However, some aspects of the process require considerable attention. Corrosion problems are severe if proper materials of construction are not employed. The handling of nitrogen solutions is comparatively new, and the use of corrosion-resistant metals is considered necessary at this time. By adding corrosion inhibitors to the nitrogen solutions, it is also possible to employ carbon steel where mild corrosion is tolerable.

Since the Texas City disaster, everyone has been very conscious of the fire and explosion hazards involved in handling ammonium nitrate. Because of this, every precaution is being taken by Phillips to prevent hazardous conditions at the Etter plant. Modern equipment is being installed to prevent dust spreading, together with what are considered adequate fire fighting facilities. Automatic controls are being included to regulate maximum temperatures wherever a hazarous condition might exist. With the precautions being applied, no trouble from fire to explosion is being anticipated at Etter.

Ammonium Sulfate

Ammonium sulfate is another form of nitrogenous fertilizer in which the

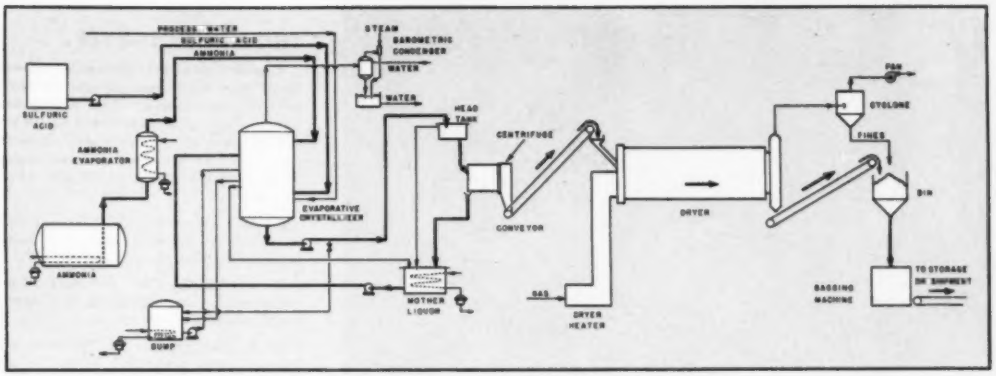

Fig. 7—Flow diagram: manufacture of ammonium sulfate

nitrogen from ammonia can be applied. Until recently this material has been supplied as a by-product of coal coking operations. Since the war, however, and with the advent of the synthetic ammonia plants, ammonium sulfate is now produced commercially by the direct neutralization of sulfuric acid with ammonia.

Phillips Chemical Co. has built and has in operation a large ammonium sulfate plant at Pasadena, Texas, near Houston. The process employed is outlined by the flow diagram shown in Fig. 7.

In the Phillips plant, anhydrous ammonia is evaporated in a shell and tube evaporator, and is then reacted with sulfuric acid to form ammonium sulfate according to the equation:

$$2NH_3 + H_2SO_4 \xrightleftharpoons{H_2O} (NH_4)_2SO_4$$

The formation and crystallization of ammonium sulfate is accomplished in a combination reactor-crystallizer, more commonly called a saturator. When ammonia and sulfuric acid react considerable heat is liberated by the reaction. The resultant boiling solution is concentrated when the heat of reaction is removed by flash evaporation of water. In this way, most of the feed water is removed, and a supersaturated solution of ammonium sulfate results. When this solution circulates downward into a gently agitated slurry of crystalline ammonium sulfate, the supersaturated solution gives up part of its sulfate. This causes the formation of new crystals and the growth of existing crystals. Thus, by controlling the operating conditions, it is possible to regulate the size of crystal produced.

The crystalline ammonium sulfate is removed from the saturator as a slurry, which is filtered on a continuous centrifugal filter to produce a crystalline mass containing less than 2% moisture. The mother liquor from the centrifuge is returned to the saturator as recycle. A long belt conveyor delivers the wet crystalline mass to a rotary dryer which completes the drying operation.

The resulting product is a fairly uniform crystalline ammonium sulfate containing about 21.5% nitrogen. Ammonium sulfate is not considered to be hygroscopic, and can be stored or shipped in bulk. Most domestic consumers, however, prefer to have the sulfate packaged in paper bags of 100 pounds net weight.

The manufacture of ammonium sulfate is old, so most of the chemical engineering problems have been solved by this time. Corrosion is still a problem, however, and there is room for better materials of construction and better methods of handling bulk ammonium sulfate

Sulfur from Petroleum

The only major raw or process material in the Phillips Chemical Co.'s nitrogenous fertilizer program which does not originate from petroleum is sulfuric acid or sulfur. It is well known, however, that sulfur can and is currently being derived from petroleum sources. Several oil companies now have plants which extract and recover sulfur from high sulfur bearing natural gas or crude oil. Some of these plants are located in Arkansas, Wyoming, and California.

Urea

Urea is another nitrogen compound which is showing promise as a nitrogenous fertilizer. Urea compounds apparently make their nitrogen content available as plant food more slowly than ammonium nitrate or sulfate. Because of this, a spring application of a urea fertilizer will continue to supply plant food throughout the full growing period of a plant.

Urea is produced from ammonia and carbon dioxide, the latter being a principal by-product of a synthetic ammonia plant. At present there is little demand for the by-product carbon dioxide, so the production of urea to utilize it might prove very attractive. Any future increase in demand for urea will probably tend to bring about its production by synthetic ammonia manufacturers.

Conclusions

In recent years, there has been a shifting of nitrogen fertilizer production from the older chemical industries to the petroleum companies. This has been brought about by the advent of the synthetic ammonia process from natural gas, a relatively cheap raw material and source of power. The petroleum industry has done much with high pressure, and temperature catalytic reactions; and is, therefore, well able to handle the problems involved in the ammonia and related manufacturing processes.

In briefly interviewing the world's fertilizer requirements and production, it becomes ever more certain that the total demand for fertilizers will gradually increase. Causing this is an ever increasing population, and the gradual depleting of plant foods in the soils of the earth.

The authors would like to point out, however, that the use of chemical fertilizers is not the complete solution to soil conservation and high productivity. Our farmers and agriculturists must also apply scientific methods of preventing soil erosion and the depletion of organic constituents of the soil. It is only through an integrated soil conservation and fertilizing program that we can hope to realize continued high productivity from the farms. The advent of cheap synthetic ammonia is and will continue to do much to prevent a gradual decline of soil fertility.

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THIS MONTH'S COVER . . .

Usable valves and fittings reclaimed from this huge typical pile of "lost scrap" emphasizes that a regular salvage operation conducted as an integral part of overall valve maintenance at Sun Oil Co.'s Marcus Hook refinery pays heavy dividends. For example:

1—Out of every 100 valves going into service, 20 were reclaimed from scrap piles like the one at the left.

2—Reclaiming is performed on tailor-made, shop-designed and shop-built machines.

3—A background of "know-how" enables shop personnel to tackle all kinds of valve repairs.

4—"Shelf" stocks are kept up, readily available for use, thus reducing process unit downtime.

VALVE SALVAGE PAYS

. . . when It's Part of Routine Maintenance

RIGOROUS STANDARD TESTS must be passed by all reclaimed valves; here a 4-in. gate is checked for leakage with 100 psi. air

By ***WILLIAM C. UHL***
Equipment Editor

VALVE maintenance has been developed to a high level of efficiency at Sun Oil Co.'s Marcus Hook, Penna., refinery by making reclamation and salvage an integral part of the operation.

For example; in a year's time, an average of 20% of all globe, gate, special plug, and safety valves taken out of the refinery storehouses for use in the plant originally were worn or damaged valves which had been removed from service and reclaimed. The remaining 80% are, of course, new purchases. These figures are based upon an annual summary report of the valve department for a recent typical year, shown in Table 1.

The savings in new valve purchases help justify economically the large amount of shop time spent in valve reclaiming. Another important—and a direct—result of the valve reclaiming system is in keeping up "shelf stocks," thus helping to reduce down-

time. All valve repairs are handled in the shop. When a process unit goes off stream, faulty or worn valves can be replaced immediately and then repaired or salvaged at leisure in the shop rather than being repaired in the field.

In addition to the straight valve work, the shop does the following jobs (most of them designed to save valuable equipment and materials from the "scrap heap"):

1—Inspects all new valves purchased.

2—Reclaims and sells to the central stores department such items as pipe, ells, tees, flanges, angle and channel iron, and lead.

3—Repairs motor-operated valves and gear units.

4—Handles the field cleaning of heat transfer equipment.

5—Collects and sells miscellaneous scrap.

6—Collects, washes, and returns to service all sample bottles used in the refinery.

Table 2 indicates the extent of some of the extra, or "nonvalve maintenance" jobs the department is able to carry on. The shop does not repair or maintain control valves. That type of equipment is handled by the refinery instrument department, since control valves fall more into the instrument than the valve category.

The idea of a valve salvage and reclamation shop at Marcus Hook is not new. It began about 1930, and has developed gradually into a relatively large and efficient organization. Total shop personnel today numbers 25 men, in addition to 5 in office or supervisory positions. There are 13 first-class mechanics; 4 second-class mechanics; 7 first-class helpers; and one welder, who is on permanent assignment to the shop from the welding department.

Office and supervisory people include the following: a foreman and assistant foreman in direct charge of the shop, an inspector, and an office clerk. The refinery general foreman in charge of labor has overall supervision of the department.

Valve work by the shop can be broken down into three major activities: inspection of new valves; field inspection during turnarounds; and repair, maintenance, and reclamation of used valves.

All incoming valves from suppliers are delivered to the shop for inspection before being sent to the storehouse or direct to service. The shop is authorized to reject on the basis of all specifications except metal. This latter is handled by a refinery metallurgist, who makes periodic stops at the shop to check new valves.

Close adherence to specifications, with rejections being made on a

SHOP-BUILT MACHINES speed up the return of valves to shelf stock or to service. These turntables are grinding and polishing gate valve discs

EVEN SMALL VALVES, under 2-in. sizes, receive the same full treatment in their travel from "scrap heap to service" in Sun Oil's Marcus Hook refinery in this "one man" operation devoted exclusively to such valves

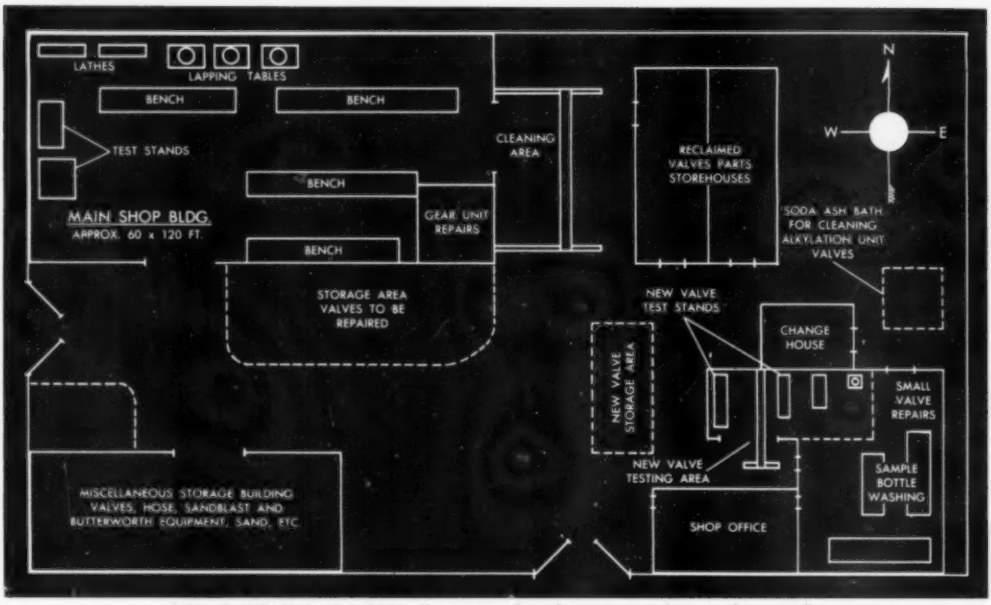


FIG. 1—GENERAL LAYOUT of entire valve shops area, shown schematically

strict and impartial basis, has enabled Sun to drop an earlier practice where a field inspector was sent periodically to the plants of the various valve manufacturers to spot-check purchases before they were shipped to Marcus Hook.

Field inspection during turnarounds serves to augment and also to substantiate what reports have already been made to the valve department by the process department on faulty valves. Routine procedure during the shutdown is for regular field pipefitters and mechanics to disassemble valves on the specific unit undergoing the turnaround. Valve shop men then check the valves for corrosion, erosion, cracks, pitting, etc., and make the decision as to whether or not they should be replaced.

TABLE 1—Total Valves Handled During a Typical Year

Size, in.	Repaired and ret'd to service	Reclaimed and sold to stores	New valves Inspected
⅛	...	...	12
¼	180	124	4084
⅜	39	46	1184
½	619	425	8001
⅝	451	237	4369
1	332	251	3030
1¼		12	405
1½	323	71	1277
2	619	180	2024
2½	117	9	74
3	581	92	625
4	678	153	731
5	3	3	....
6	523	92	460
8	205	54	214
10	48	16	119
12	45	12	43
14	30	1	7
16	16	...	3
18	4	....	....
20	...	...	1
Totals	4,813	1,778	26,663

TABLE 2—Materials Other Than Valves Reclaimed in a Typical Year

Pipe (12 sizes, ¾ to 12 in.)	14,185 ft.
Flanges (43 different sizes)	1300
Ells (12 sizes, ¾ to 10 in.)	435
Tees (8 sizes, ½ to 6 in.)	115
Angle and channel iron	1237 ft.
Lead	4342 lbs.
Miscellaneous work:	
Motor-operated valves repaired (7 sizes, 4 to 18 in.)	36
Gear units repaired	61
Sample bottles washed (approx.)	1,000,000

Handle Outside Jobs Also

Repairs on used valves cover all those brought to the shop as a result of field inspection during unit shutdowns. In addition, the shop repairs valves brought in from various bulk stations, terminals, and pipeline installations belonging to the company, as well as all motor-operated valves from the Toledo refinery, where facilities for this type of work are limited.

Once valves have been restored to working order, they are: (1) returned to service if needed immediately, (2) sent to the storehouse, or (3) kept in a small emergency stock at the shop itself. For the sake of expediency, this stock is kept up at all times. For example, an emergency during the night shift might take one or two valves out of this stock, but a regularly scheduled turnaround might be expected to take out as many as 50 or 60 valves at one time. This must be anticipated by building up the stock in advance if possible. In general, the Marcus Hook operating department prefers to use reclaimed rather than new valves.

How does the valve department

function during a unit turnaround so as to help achieve minimum downtime?

First, a copy of a "Shutdown Work Order" is received about two or three days before each scheduled shutdown. This work order comprises a list of all work the shutdown committee has planned to have done. Included in the list will be a number of jobs concerned with valve repair or replacement. The valve department inspector then makes up a list of all jobs from this shutdown work order, indicating whether the valves are to be replaced from the shop stocks, repaired using stock parts from the shop stores, or (if time is short) requisitioned by purchase order to the refinery central stores. This list may receive additions or revisions as a result of field inspections after the shutdown starts, when specific valves on the unit have been disassembled and checked.

Repair Work Done First

Then, when the shutdown starts, valves are picked up and delivered as soon as possible to the shop. Repair jobs are handled immediately. Replacements which are salvageable are set aside for leisure time reclaiming or disposal.

Valves to be repaired are first cleaned with steam and/or Oakite solution in an outdoor cleaning area adjacent the main shop building. Then they are sent into the shop and assigned to specific mechanics. If further cleaning seems needed after the valve has been dismantled, it is done immediately, before any repairs are started. This may be necessary, for example, with the specially-designed plug valves Sun developed for use on the alkylation units. These are usually given a soda ash bath. Hazardous deposits cannot always be removed during the initial cleaning, but can be taken care of after the valve has been dismantled.

All necessary repairs are then made. The repairman makes his own inspections and calls on the department inspector only for the final OK. The shop has several home-engineered and -built machines for lapping wedges and gates. Rings are usually lapped in place.

The same mechanic follows through all the way on the valves assigned to him. He finishes his work by running them through the prescribed routine tests on the shop-built test stands. Then he puts a tag on each one with the valve number, repairs made, date, and his own clock number. He also makes out a daily report for the office records indicating the hours spent on each job assignment.

Valves wanted back in service are of course returned immediately to the process areas. Others are sent to the valve shop stock. As this stock builds up, surplus valves are sold to the central storehouse. For the records, such valves resold to central stores carry a standard charge of 30% of the current price of a new valve.

It should not be inferred that the shop has a large amount of "leisure time" to spend on the valve reclamation work. In a 140,000 b/d refinery like Sun's Marcus Hook plant, unit shutdowns are scheduled rather frequently, perhaps every week or two. However, planning and careful scheduling enables the valve shop to accomplish an extensive amount of work, as the records in Tables 1 and 2 demonstrate.

One important reason for this is in the various shop-built machines used in the repair work. Another is in the way the department is laid out.

The machines are shown in some of the accompanying photographs. Equipment in the main building (see Fig. 1) includes three lapping tables, two lathes for work on valve stems

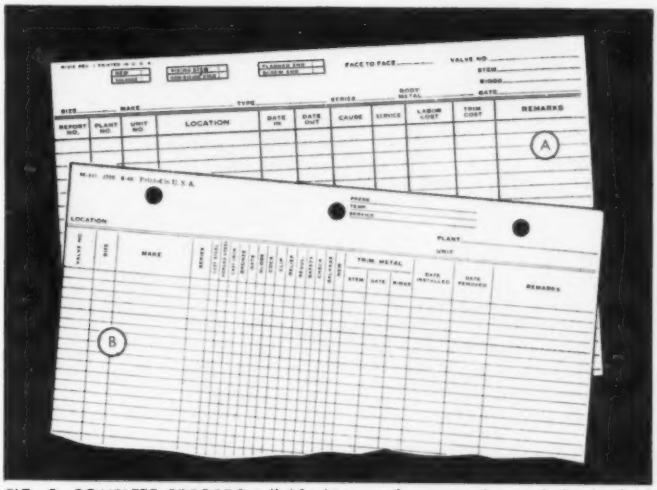
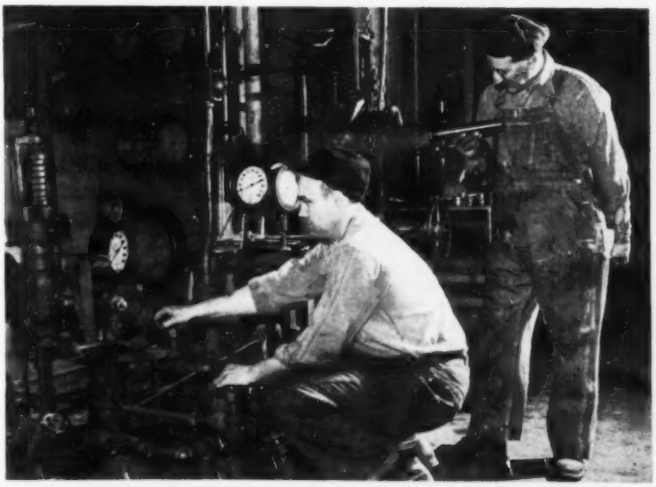
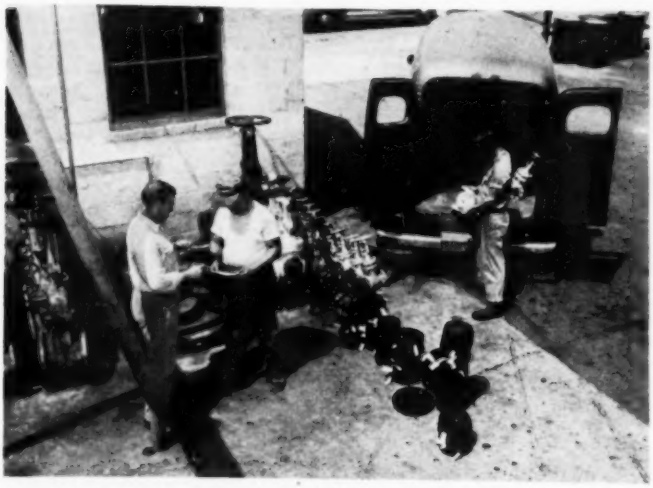


FIG. 2—COMPLETE RECORDS tell life history of every valve and the kind of operating conditions it has undergone



TEST EQUIPMENT, like repair machines, also is shop-built at Marcus Hook. Here a safety valve is checked at up to 2500 psi.



NOW AS GOOD AS NEW, valves, fittings, etc., reclaimed and reconditioned in the shop, are being readied for return to the refinery

and another one for general work, and two test stands. In addition, the old shop building contains two more test stands for checking new valves, and a small lapping table which is used exclusively for valves 2-in. and under.

The lapping tables in the main shop building include two using wet abrasives. One is for large heavy gates; the other for smaller, lighter gates. The third machine has an emery covered table and is operated dry for rough, preliminary grinding. Each machine is equipped with a jig for holding the gate in place on top of the revolving table. A handle on the jig permits the workman to guide the gate in an oscillating motion across the table.

The test stands were designed in two types. One checks flanged valves for proper seating; the other is a pressure gage arrangement for safety valves. Pressures up to 2000 psi. can be obtained. An old gasoline (automobile) engine was rigged up to drive an air pump for this set-up.

Overhead material handling equipment is used advantageously in the shops and open areas. In the main building a traveling crane hoist (electrically-operated) takes care of the major portion of transferring heavy valves and other equipment from one spot to another. A smaller crane hoist on a swing boom is located at the two test stands to facilitate work at that point. Outside the building at the cleaning area is an overhead rail and chain hoist. Another rail and chain hoist is located at the new valve test area with the rail arranged for moving equipment in or out of the old shop building.

Smooth Flow of Work

The physical lay-out of the shops and various areas in the valve department provides for relatively smooth flow of work. Located on about one acre of land across the street from the north side of the refinery proper, the department receives and delivers its work, materials and supplies by truck. The largest building is the new main shop, on the northwest corner of the plot (see Fig. 1). Of steel construction with sheet metal walls, this shop measures approximately 60 x 120 ft., with a gable roof and headroom of 20 ft. Immediately adjacent this structure, along its east wall, is the cleaning area. Beyond that are two wooden buildings which serve as storehouses for reclaimed valves and parts.

Along the south side of the plot, and facing the refinery, are the miscellaneous storage building, the shop office, and the old shop building. A small change house is attached to the north wall of the old shop.

The heaviest volume flow of materials—chiefly valves to be repaired or reclaimed—comes by truck through the South gate to the open-air storage area in front of the south wall of the main shop. Valves then move to the cleaning zones and finally to the proper repair locations. The smaller volume of shop "business"—new valves for inspection—are sent directly to the testing area.

All repairs except those on valves smaller than 2-in. take place in the main shop. The small valves are the responsibility of one mechanic, who works in the rear of the old shop.

Shop personnel work an 8-hour, day-time only, basis, for a 40-hour week. No overtime hours are charged, although the shop operates on Saturdays. This is handled by using a skeleton crew on the sixth day, comprising two standby mechanics and one laborer. Men are assigned to Saturdays on a rotating basis. An employe whose work week is to include Saturday is automatically given some other day in the week off.

Record All Data

The most important information kept in record form in the shop office is covered by two types of 5 x 8-in. file cards. One, shown in Fig. 2A, provides a complete, historical record on each valve from the time it is received as a new purchase. Study of just a few of these cards will soon indicate that Sun's valves give many years of service beyond their normal life expectancy, because they are reclaimed as often as necessary.

Cards of the design shown in Fig. 2A are filed numerically and by valve size. Complete physical information is filled in at the top of the card, and then further details are entered in the various vertical columns as the valve moves from location to location. This historical data tells the valve department what kind of service the valve was exposed to, how well and how long it stood up under each kind of operating condition, and what factors seem to influence its life.

Supplementing the information on this card is that obtained on the card shown in Fig. 2B. This is a record of the valve types used in each location in the refinery, how long each type gave good service, and includes of course some data also found on the first card. This latter card is filed by plant, by unit in that plant, and by location in that unit.

Jobs Given Prority Rating

While the use of tailor-made repair equipment, the keeping of careful records, and the constant watching for salvageable materials all contribute markedly to the efficient operation of the reclamation department at Marcus Hook, probably the most important factor is the close attention paid to a priority rating for all jobs.

This rating places at the head of the list all maintenance and repair work connected with shutdowns. In the second place is the repair of valves when the shop stocks are low. On an equal footing as number three is the inspection of new valves and the repair of valves and parts in general for stock.

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When The Texas Company built its first Fluid catalytic cracking unit back in 1942, Kellogg did the job. Since that time, Kellogg has erected seven additional crackers for Texas refineries in New Jersey, Illinois, Oklahoma, Wyoming, Texas and California.

Historically, Kellogg undertook its first job for Texaco back in 1929... a thermal cracker at Amarillo, Texas. During World War II, Kellogg designed a Hydroforming unit for the production of high octane components for aviation gasoline. Built at Lockport, Illinois, it was the forerunner of Texaco's vast post-war modernization and expansion program.

Within the past year, Kellogg has completed thermal reforming and catalytic polymerization facilities, as well as a catalytic cracker at Texaco's new refinery, Eagle Point Works, at Westville, New Jersey.

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M. KELLOGG

Portrait at

This year is Kellogg's fiftieth of service to industry. At this time naturally, as a group of men—known collectively to the modern business world as The M. W. Kellogg Company—we can think back nostalgically. We can remember the chimney stacks

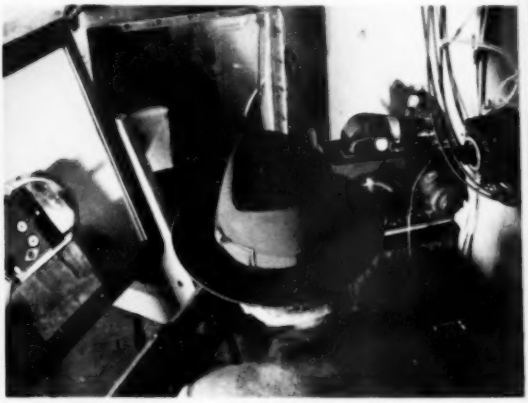
"Against Tomorrow's Conditions"

The first two of these camera "portraits" of M. W. Kellogg today which have already appeared in this publication, high-lighted the major aspects of the chemical, metallurgical and process research carried on by the Kellogg organization.

This month, a few of the continuing development projects based on this research are described —with indications of their importance in the advancement of processing, engineering and fabrication.

1. ***WHILE THE PRIMARY ACTIVITY*** of the Metallurgical Engineering group is concerned with the everyday problems of Kellogg operations, these facilities have also been utilized in connection with national defense. Because of their knowledge of metals and heat exchange, the services of these men have been required in the design of rockets and jet turbines. Here you see the engineering personnel assigned to this task.

4. ***IN GAS AND ELECTRIC FURNACES*** such as this, metals are subjected to temperatures approaching those of rocket engines in operation . . . and useful data from post-heat conditions of the materials can then be derived. Evidence of the success of Kellogg's work in these fields is seen in the fact that this development group has recently perfected a new method of heat exchange jacketing for combustion chambers.



5. ***KNOWLEDGE OF THE MECHANISM*** of combustion of various fuels is as essential to the design of familiar process furnaces as it is to special combustion chambers. Here you see a test chamber for rocket and jet fuel study. In the future, such studies will stand industry in good stead as process plants are required to produce special jet and rocket fuels in quantity.

Fifty... no. 3

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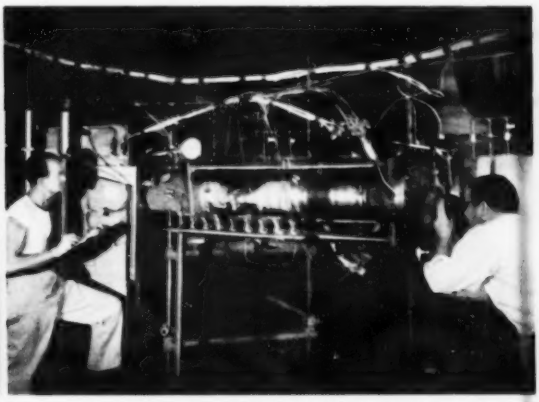
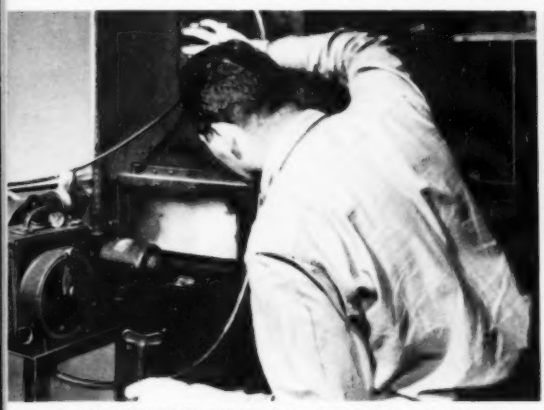
we built in 1901 . . . the first crude vessels for oil refiners in the 'teens . . . our first combination unit. The forty-odd Fluid cat crackers built in these years. But, after all, The M. W. Kellogg Company is only a factor as it is able to serve industry today. For that reason, we are presenting this series of monthly camera studies which document our belief that a truly integrated organization can better serve industry to achieve greater earning power. This is No. 3 in the series.

2. *AT FIRST GLANCE* these specialized projects may appear far removed from the direct interest of the oil refiner. But the facts are just the reverse. The solution of rocket and jet turbine design problems opens new ranges of operating temperatures, new types of heat exchange equipment and tremendously improved turbines and pumps. Modern dynamometers are employed in studies of various types of turbines and pumps.



3. *IN THIS MINIATURE TEMPERATURE CHAMBER,* stratospheric frigidity can be created outside of a piece of equipment while it operates at super temperatures inside, or vice versa. This is a modern counterpart of the development which Kellogg instituted more than twenty years ago, when it began investigating the effect of low temperatures on metals in connection with propane lubricating oil processes.



6. *AN IMPORTANT PHASE* of the study of fuels is the observation and recording of the act of combustion itself—which is carried out by this apparatus—by means of high-speed color photography of flame characteristics and fuel burning. Other facilities include stands and firing pits for the testing of completed prototype rocket motors. The group has designed and built rocket motors with thrusts up to 30,000 lbs.

7. *THESE ELECTRONIC SIMULATORS* are indicative of the equipment placed at the disposal of the company's development men. Similar in purpose to the giant electronic calculating machines, they provide shortcut answers to design problems requiring extensive time-consuming mathematical calculation.

NEXT MONTH

. . . in the fourth in this series of camera studies of M. W. Kellogg today . . . you will see how Kellogg channels the results of development into a specific industrial project.

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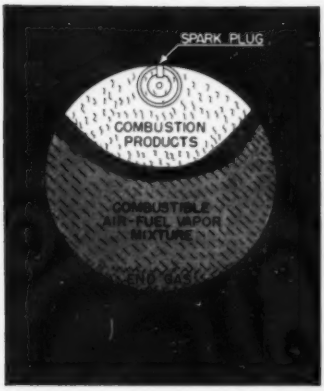
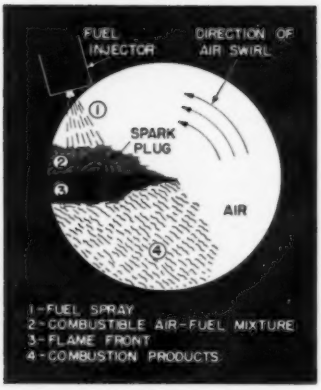




KNOCK-FREE engine performance can be achieved either by tailoring the fuel to meet the engines needs, as for the conventional Otto Cycle Engine (left), or by designing the engine to burn whatever fuel is available, as in the new Texaco Combustion Process (right). In the first case you have "chemical octane;" in the second case you have . . .

Mechanical Octane

*A New Concept in Motor Fuels**

By BLAKE REYNOLDS
Texaco Development Corp.
New York City

OCTANE is *not* a property of gasoline. Today octane has assumed a variety of meanings, all of them relative. It might be well, therefore, to consider what the word connotes in its most general implications. What, for example, does it mean to the average motorist?

To him octane is simply something that keeps his engine from knocking. Also, he knows that higher octane permits higher compression. At this point his rather vague notions stop. The rest is up to the oil companies—it's their job to turn out gasoline that does the best job in *his* engine. Although he'd never put it this way, the motorist feels that efficient, knock-free combustion is a problem in fuel chemistry.

In the "chemical octane" approach to the problem, the motorist unconsciously reflects the thinking of a large body of trained experts in the field of automotive transportation. This is the traditional orientation of the octane problem. It is a costly and wasteful approach for it ignores an alternative, the "mechanical octane" approach.

The term "mechanical octane" is a fairly recent one, which is currently being used to label the new point of view under which the Texaco Combustion Process has been developed. As a generalized term it has encouraging implications for the refiner for it hints at a way out from under the tremendous capital burden which the so-called "octane race" has strapped squarely on his shoulders.

The Texaco Combustion Process has shown that *octane* as the generalized concept which in the public mind is equated with efficiency is a property which can be achieved by engine design. The process is still in the research phase. However, many years of testing single-cylinder engines has confirmed its significance and practicability. A considerable development program lies ahead for the process in a variety of multi-cylinder applications. Test engine performance has shown us that the process has a considerable contribution to make in the evolution of present and future methods for making the best possible use of the greatest amount of automotive fuel which can be processed from petroleum.

The process has been reported at length in an SAE paper,[1] and in the professional, technical, trade and public press. A brief summary of the principal operational features of the process in a prototype automotive engine cylinder will suffice for the present purpose of indicating its economic implications.

In the present-day conventional automotive engine, combustion knock may be explained as follows. A mixture of air and vaporized fuel is drawn into the combustion chamber during the suction stroke of the piston. During the compression stroke the air-fuel mixture is compressed into the top of the combustion chamber. During compression it is heated from being forced into a small space. The spark then ignites the heated, compressed air-fuel mixture. The left-hand sketch above shows the process shortly after the air-fuel mixture has been ignited. The flame spreads out in a fan-shaped pattern across the combustion chamber. The forward edge of the burning mixture is called the flame front. The unburned air-fuel mixture is known as "end gas."

At this point, it is well to recall an important fact: the end gas has resided in the combustion chamber for a considerable period of time during which it was heated first by compression and then by the advancing combustion. Residence time is a critical factor in combustion knock. With the end gas being subjected to increasing temperature and pressure for an appreciable time, the question arises whether or not the air-fuel mixture will be completely burned before the end gas ignites spontaneously. This detonation of the unburned end gas is what is commonly known as "knock."

In this instance the risk is underwritten by the refiner who has provided the motoring public with high octane gasolines which have built into them the characteristics necessary to ward off detonation.

The Texaco Combustion Process, illustrated in the right-hand sketch, is quite another story. The system of introducing the air and fuel, and then burning the resultant mixture completely eliminates the factor of residence time.

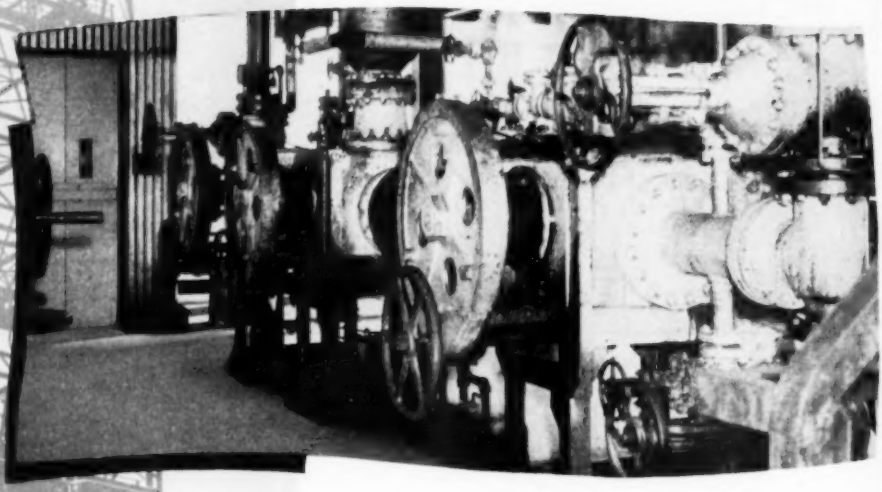
In the Texaco Combustion Process, air alone is introduced into the cylinder on the suction stroke. It is drawn in in such a way that a definite swirl is produced, sometimes at speeds up to 400 mph. During the compression stroke the air continues to swirl. When the piston is almost at the top of its upward stroke fuel injection is initiated through a nozzle across the swirling air. The resultant air-fuel mixture travels a very short distance to the spark plug where it is ignited at once. The process is continuous, succeeding portions of the fuel entering the cylinder while earlier portions are burning.

The flame front burns in a relatively fixed position. Since the mixture is burned continuously as rapidly as it is formed, there is no resident end gas to detonate. In short, combustion knock has been designed out of the engine.

At its present state of development, the Texaco Combustion Process performance data clearly indicate that a mechanical octane solution to the

* The principal portions of a paper presented by the author at the annual meeting of the Western Petroleum Refiners Assn., San Antonio, Texas, April 2-4, 1951, under the title "Knock-Free Engine Design—Texaco Combustion Process."

Wilson-Snyder Switch Valves



• The master Switch Valve in the center has one inlet and three outlets. Valves on each side have one inlet and two outlets and each one serves a coke drum. This combination readily controls the continuous flow of the charge from the coke furnace.

—distribute reduced crude to the coke drums in PAN-AM SOUTHERN'S El Dorado Refinery new coking unit.

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problem of knock has been found.

The most important feature of the process is the fact that it permits knock-free performance at high compression ratios on wide-boiling-range petroleum products without regard for octane ratings. The complete lack of knock is inherent in the design of the process. Thus, the process eliminates the need for high octane gasolines and permits the use of compression ratios as high as desired—for example 12-to-1 or higher. The economic implications of such a process are obvious.

Economic Background of Process

To refiners this means that this process in commercial application opens up a new concept of automotive fuel—no octane or cetane specification and wide latitude in boiling range, such as 100° to 600°. In continuous laboratory tests it has operated successfully on all types of gasolines in addition to iso-pentane, alcohol, benzene, kerosine, Diesel fuel, tractor fuel, triptane, iso-octane, cetane, normal heptane, jet aircraft fuels and many other products.

This non-selective fuel diet bodes well for the refiner. For example, it permits him to look ahead to long-range economical use of his older equipment which is now almost obsolete in competitive terms. Catalytic cracking equipment, to select another example, could profitably be utilized for volume production of wide-boiling-range fuels. If in the future, fuels for the Texaco Combustion Process were to be refined on a large scale, the refiner would be free to concern himself with operating his tremendously expensive equipment to produce greater yields at lower cost instead of turning out low-yield high-octane fuels at high operating costs.

In order to understand the significance of the Texaco Combustion Process, it will be well to review some aspects of the economic atmosphere in which it is being developed.

First the present census of motor vehicles. Current estimates place the figure at approximately 48,000,000. These vehicles pose a brace of problems for the refiner which, present trends prevailing, can only grow greater. The refiner must manufacture a constantly greater quantity of motor gasoline and at the same time must continue to raise the octane number of his product. This condition has given rise to the so-called "octane race" which is predicated on the chemical octane point of view.

Second—the steady increase in demand of all kinds against petroleum supply which has been the day-in day-out problem of the industry since the end of World War II. Ten years ago no one foresaw such record levels of demand, nor could they have predicted the technological progress which has caused it. As Eugene Ayres pointed out more than a year ago in an article, entitled, "The Fuel Problem"(2) ". . . the world, particularly the U. S., is committing itself irrevocably to a liquid and gaseous fuel economy." This economic perspective bespeaks the need for an austere approach which coincides with the mechanical octane solution of the octane problem. The Texaco Combustion Process, for example, delivers more work per unit of crude oil than present high compression engines.

Third—the fact that petroleum is irreplaceable. One cannot reclaim any scrap from a gallon of high octane gasoline which has been burned in an automobile cylinder. Known reserves of domestic crude have been increased in recent years, but much of the increase has been in extensions of original estimates of old fields. It would be well for the motorist, who in his role as a public-minded individual is concerned with natural resources, to think a little less about miles per gallon of gasoline and more about the potential miles per barrel of crude oil. Through refining for high octane, he stands to lose some of the mileage in crude oil before he even buys his gasoline. Present minimum estimates show that because of its non-selective fuel diet the Texaco Combustion Process can reverse this trend and permit a higher yield of motor fuel from crude oil.

Fourth—the fact that we face the prospect of another global war. There is no need to explore the implications in this perspective as it applies to demands against petroleum supply.

Fifth—a perspective which is an intimate part of refining economics. The refiner is presently committed to continuously heavy capital investment in what might be called high octane units in which he must produce products at high operating costs. This dual upward spiral of investment costs and operating costs is of grave concern to refiners. It is a problem which deserves careful scrutiny within the framework of the octane problem. In the paper which he read to the Society of Automotive Engineers three years ago, W. M. Holaday(3) traced in some detail investment costs for various types of refining processes. In each instance his figures were based on a refinery capacity of 100,000 b/d. His cost estimates were for 1948—similar estimates today would have to be revised upwards considerably to reflect present construction costs.

A straight-run refinery (of 100,000 b/d capacity) was estimated to cost $16,000,000. If the refinery were then to incorporate thermal cracking into its processing the cost would have risen to $24,000,000. Add thermal reforming and your investment would have gone to $26,000,000. Step by step through catalytic polymerization, catalytic cracking, alkylation and hydroforming, Holaday traced the steady increase in estimated costs. The unit which incorporated catalytic cracking and alkylation would have cost in the neighborhood of $65,000,000.

With a look to the future, Holaday foresaw a ". . . total refinery gasoline having an octane number of about 89/99 with 3 cc. TEL per gallon or about 87/97 with 1 ml. TEL by hydroforming all the straight run gasoline and doing all cracking catalytically . . . Such a refinery will cost about $90,000,000 for 100,000 b/d of crude oil capacity. About 20% of the straight run gasoline will be lost in hydroforming and the operating expenses will be very high."

Against this background the performance of the Texaco Combustion Process indicates the significance in shifting the emphasis of the solution to the octane problem from chemical octanes to mechanical octanes.

Commercial applications of the new process will permit an increase of 30% in miles per gallon over a present day automobile travelling under normal driving conditions.

The process eliminates combustion knock.

It permits the increase of compression ratio without regard for the octane number of the fuel.

The process disregards octane number and it can use fuels of a wide boiling range. These facts combine to permit a greater yield of motor fuel from crude oil—perhaps 15% in a typical refinery.

The process will permit the use of supercharge in combination with high compression ratio without regard for the octane number of the fuel.

Because of its ability to burn lean mixtures, the process will deliver greater part-load fuel economy than present-day automotive engines.

The process has been discussed here only in terms of its automotive application. The principles and operating efficiency apply just as well in the case of military, marine, industrial, agricultural, and other applications.

In military application, the commercial development of the process can be of great value. It could deliver more power per pound of engine, and more miles per pound of fuel . . . it could simplify supply, storage, and transportation problems . . . and it could, in short, relieve the military of a number of serious logistical problems.

Because it is a reasonably simple design which can be applied to a variety of engines, the Texaco Combustion Process points the way to a tolerable accommodation of the needs and interests of both the petroleum and the automotive industries.

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(1) Barber, E. N.; Reynolds, Blake; Tierney, W. T., "The Elimination of Combustion Knock — Texaco Combustion Process," *SAE Quat.*, 5 (1) 26 (1950).
(2) Ayres, Eugene, "The Fuel Problem," *Scientific American*, pg. 32, Dec., 1949.
(3) Holaday, W. M., "The Efficient Production and Utilization of Motor Gasoline", *SAE J.*, 56 (5) 30-6 (1948).

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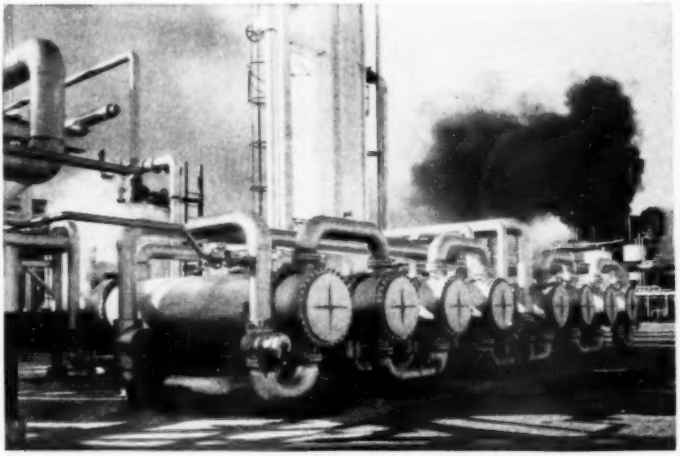

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Ethylene Glycol
Glycerin
Hydroabietyl
Isopropanol
Methanol
Phenol
Propylene Glycol
Acetaldehyde
Formaldehyde
Furfural
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Gasoline
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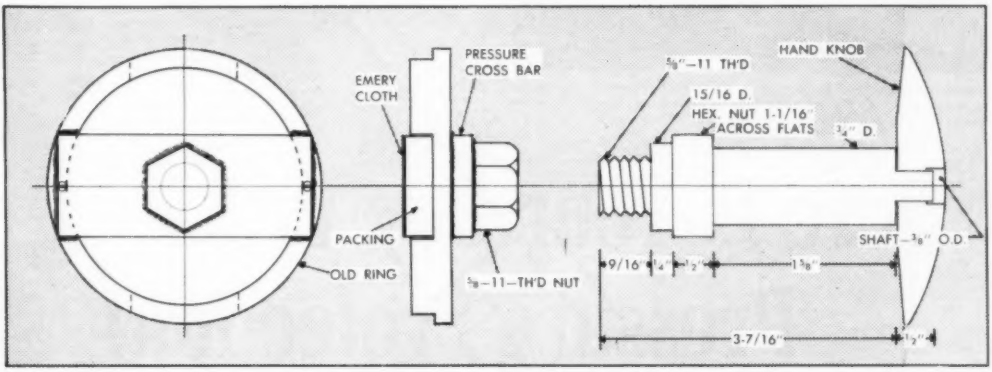

FIG. 1—Sanding jig that saves time cleaning ring type joints

Sanding Jig Cleans Ring Type Joints On Valves and Flanges in "Jig" Time

By DAN J. LEWIS, Socony-Vacuum Oil Co., Inc.
Augusta, Kansas

A HAND-OPERATED sand jig for cleaning ring type joints on flanges and valves, developed in the shops of Socony-Vacuum Oil Co.'s Augusta refinery, has effected as much as 60% saving in time over previous manual cleaning methods. In addition, the quality of the job was improved. An even greater time saving can be realized if the jig is adapted for use under motive power.

The use of ring type joints on valves and flanges during recent years has presented a problem of cleaning not encountered before on raised face, American type, or tongue-and-groove fittings. The ring type joint is a metal-to-metal contact. In hot services, the lubricant used to prevent galling the ring will bake out and deposit an extremely hard scale that must be removed before the joint can be used again.

In the past this cleaning has been done with sand paper, carborundum, and similar materials. It is a time-consuming and difficult cleaning job. The sanding jig which has now replaced former methods is shown in Fig. 1. A used ring can be used by cutting two or four slots, approximately 1½-in. long, on one side of the ring and diametrically opposed. Pieces of packing wrapped in abrasive are placed in these slots. Cleaning involves pressing the jig against the face of the ring joint and rotating it with a suitable handle.

The rings can be made in various sizes for different size jobs. Their length should average ⅛ of the circumference of the ring and they should be located under the pressure cross bar which is welded to the opposite side of the old ring. The dimensions of the pressure cross bar can vary but should be sufficient to prevent permanent set in the ring.

Slot depth can vary with the size of the packing. Johns-Manville "Rajah" style No. C-6 square braid coil packing can be used, in a size to fill the ring groove. This packing is wrapped with strips of emery cloth—100-grit for average use, 150-grit for light jobs.

The handle assembly (at the right in Fig. 1) has a ⅝-in. diameter thread at the end which fits into the nut welded to the pressure cross bar on the jig. The knob, by which pressure is applied to the ring, is 2⅜ in. O. D., made from ⅝-in. plate. Diameter of the center hole is 7/16 in., and it is center-drilled ½ in. to a depth of ⅛ in. The ⅜-in. shaft on which it fits has the end peened over lightly, enough to hold the knob in place and allow it to rotate freely.

Rotation is provided by a 1—1/16 in., 12-pt. box socket wrench (not shown) which fits over the hexagonal nut on the handle assembly. A pipe extension on the wrench provides a handle length of 14⅜ in. The wrench and the handle assembly can be replaced with an air-motor drive if desired.

As an example of the time saving with this sanding jig, two 3-in. ring type flange joints were cleaned. One cleaned with the jig required 10 minutes for the job, including cutting the packing and wrapping the abrasive paper. The other joint, cleaned by former hand methods, required 25 minutes and the quality of the job was inferior. A 2-in. flange was cleaned with the jig under power, and the time required was 2 minutes.

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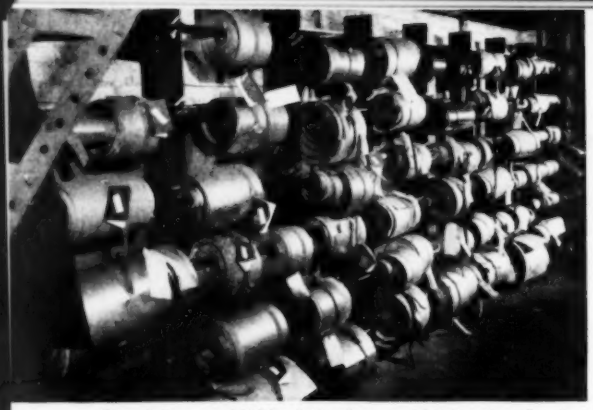

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with other duties so that more or less caustic than the required amount was being injected. Because the quantity of caustic added was critical, some other means was sought to control its injection.

Automatic scales were installed and the caustic solution was weighed into an individual drum at each kettle. The bottom of each drum was equipped with a one-foot section of 3-in. diameter pipe. On this pipe was installed a Moore Products Co., electric-type, flexible shaft, level control. A very slight movement of the float in this type level control operates a microswitch. The microswitch was wired into the holding coil circuit of the motor operating the caustic injection pump. The pump took suction on a one-in. line connected to the bottom of the three-inch leg and discharged into the process kettle.

After the caustic solution was weighed into the individual drums, all the operator had to do was start the pump. As the caustic was pumped in, the level controller automatically shut the pump down at the same level, each time resulting in a very uniform addition of caustic solution.

This item is based upon information in the paper "Gadgeteering" by J. M. Jones, Jr., The Texas Co., Port Arthur Works, presented at the 1949 *symposium on Instrumentation for the Process Industries of Texas A&M College. A major portion from Mr. Jones' paper was published in* PETROLEUM PROCESSING, *pages* 275-278, *March*, 1951.

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Close Control Is Obtained On Tower Liquid Level

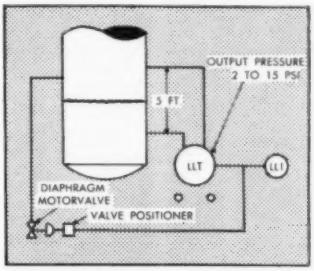

FIG. 2 — Instrument arrangement for obtaining close level control in a tower

IN cases where a liquid level transmitter is used to control the level in a tower by actuating the inlet valve, the range of "on to off" of the valve can be kept to narrow limits of level; for example, 1 foot or whatever is desired. As worked out by instrument department personnel at Esso Standard Oil Co.'s Baltimore refinery, the procedure involved use of a valve positioner on the inlet valve, set for on-off between very narrow pressure ranges.

The arrangement is illustrated in the schematic drawing, Fig. 2. For a hypothetical case, suppose the tower is 18 to 23 ft. in height and the liquid level transmitter taps are 5 feet apart. Actual level desired is within a 1 foot range somewhere within this 5 feet. The transmitter taps cannot be set at the 1 foot range because of the possibility of process upsets which might run the liquid level beyond the taps. In that case, all control would be lost. On the other hand, with the level transmitter's output pressure of from 2 to 15 psi. and no positioner on the inlet valve, all the on and off movements of this valve would not occur except over the full five feet between the taps.

The solution was to set the valve positioner at a narrow range; for example, 3 to 4 or 5 to 7 psi. In that way the inlet valve travels full range for any small variation of output pressure from the transmitter within the 3 to 4 or 5 to 7 psi. range.

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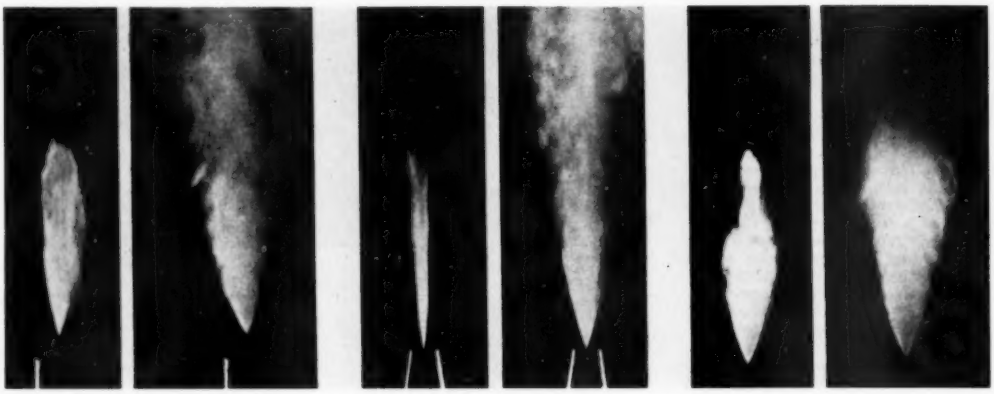


TYPICAL STROBOSCOPIC PHOTOGRAPHS used to determine the length of fuel injection periods. Views at the left of each pair of pictures above show the shape of the spray at time it would be ignited in an engine (3° after beginning of injection). Those at right show fully developed sprays

Fuel Spray Pattern

Aids Injection Studies with Test Stand Utilizing Stroboscopic Light Device

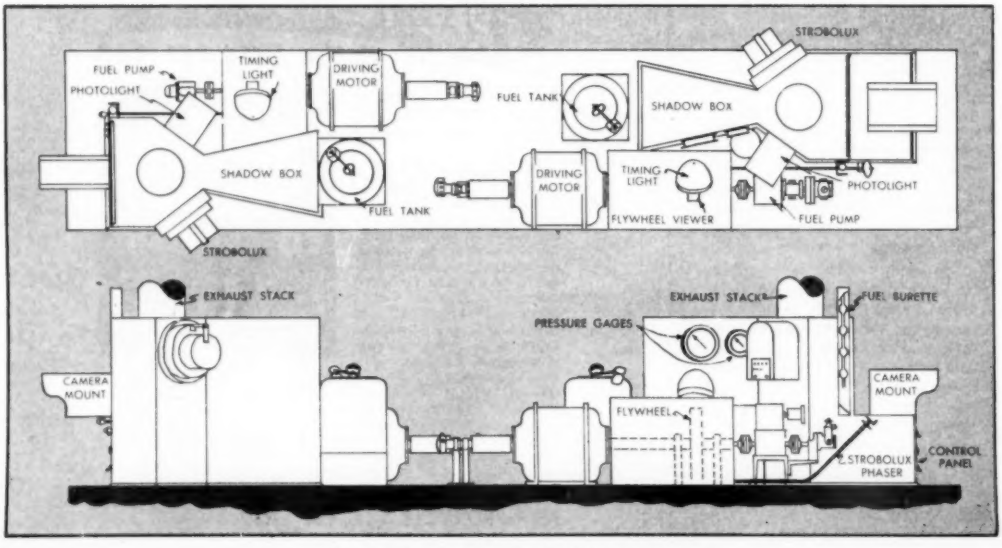


FIG. 1—Test stand for the fuel injection studies

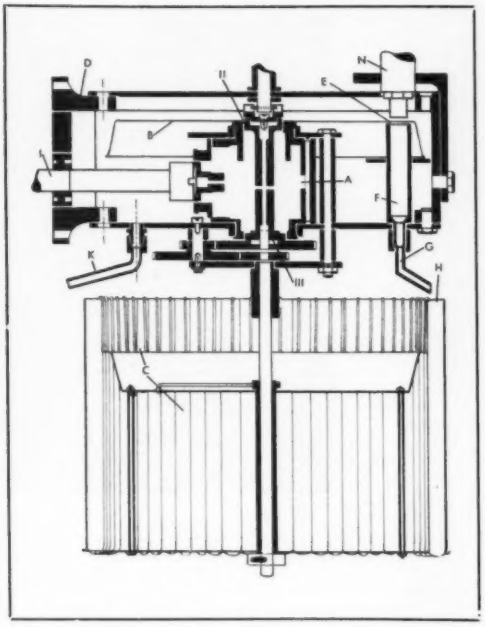
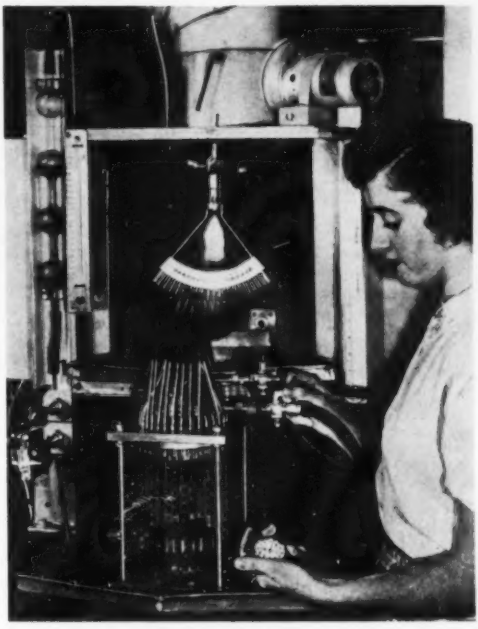


FIG. 2—Strobo-disc device (from a patent drawing)



STROBO-DISC DEVICE in use

ALTHOUGH developed primarily for use on a particular project, a fuel injection test stand at the Beacon, N. Y., research laboratories of The Texas Co. can be and is being used for a variety of internal combustion engine fuel studies.

The stand was assembled for the observation, study, and measurement of fuel spray and fuel injection system characteristics through the use of stroboscopic light. It consists of duplicate stands for mounting fuel pumps, four-speed electric motors for driving the pumps, fuel supply and metering systems, and observation chambers in which the fuel spray nozzles are placed. An exhaust system carries away fuel vapors from the observation chambers. A general plan and side view of the layout is shown in Fig. 1.

In addition to visual observation of the fuel spray, accessory apparatus on the stand provides for making the following measurements: penetration, photographic recording of sprays, duration of injection period, rate of fuel spray propagation, and rate of discharge.

Fuel spray penetration is defined as the maximum distance from the tip of the injection nozzle to a so-called "spray grid" for the spray to cause an identifying mark on the aluminum foil held in the spray grid. This distance is measured in inches.

The spray grid, shown in the photograph on next page, is constructed of steel plate, having a two-inch square section in which grooves ($\frac{1}{32}$ in. wide, $\frac{1}{8}$ in. deep, spaced $\frac{1}{32}$ in. apart) have been milled at right angles to form waffle-like projections. Relief holes are drilled at intervals from the bottoms of the grooves through the plate. A removable frame, retained by screws, holds the aluminum foil against the grid.

Grid Pattern on Aluminum Foil

To obtain a penetration determination, the grid with aluminum foil in place is put in the path of, and perpendicular to, the axis of the spray. Then it is lowered gradually toward the nozzle until the fuel spray registers on the foil. The distance from the spray grid to the nozzle, in inches, is the indication of the penetration. Three to five determinations, which should check within ± 0.5 inches, are made and averaged.

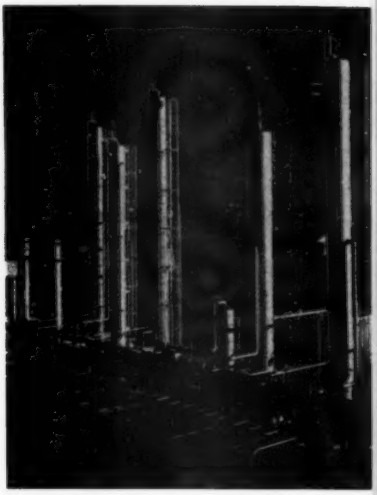
The fuel injection test stand has been so designed that photographs of sprays can be taken for a permanent record. The plan view in Fig. 1 shows the arrangement of the observation cell. The lights are located approximately nine inches from the spray and to the rear and side. The shadow box provides the proper background for visual or camera observation. The injector directs the spray vertically within the test chamber.

The lights can be flashed synchronously with the fuel pump so that phasing with respect to the spray may be varied or fixed as desired. The strobolux light can be fired either continuously or single shot, but the photolight can only be fired single shot. The former, having about 50 micro-seconds flash duration, is used to observe visually and to set the conditions for photography. The latter, having a duration of 2 to 4 microseconds, furnishes the illumination for the camera work. A new photolight with a duration of 1 to 2 microseconds has recently been put in service.

After the conditions have been set, the strobolux is shut off, the camera shutter is opened to expose the film, the photolight is flashed, and the shutter closed. Typical spray pattern pictures have been taken with a Zeiss Ikon, 9 x 12 cm., camera at f 8.0, using Kodak Super XX film.

Measurement of the duration of the injection period is accomplished by synchronizing the strobolux light with various phases of the spray. A timing light, arranged to flash against a flywheel drum on the fuel pump shaft, is connected in the firing circuit of the strobolux so as to flash simultaneously. The flywheel is graduated in degrees so that as the phase of the strobolux is changed

Stabilized



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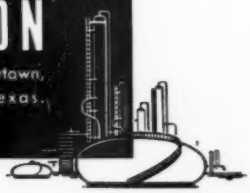


with respect to the fuel spray, the relative position with respect to fuel pump rotation may be obtained.

By synchronizing the strobolux to observe the spray as the first increment is being emitted from the nozzle, and then synchronizing the strobolux to observe the last of the spray leaving the nozzle; the difference in timing as measured on the flywheel will be the measure of the length of the injection period. See photograph at beginning of the article.

The rate of spray propagation may be measured by synchronizing the strobolux with different phases of the spray so that the timing of the beginning of the injection might be recorded and also the timing for a spray of a given length; say one, two, or three inches. Then the fuel spray velocity might be calculated as follows:

$$V = 5\,LN/D$$

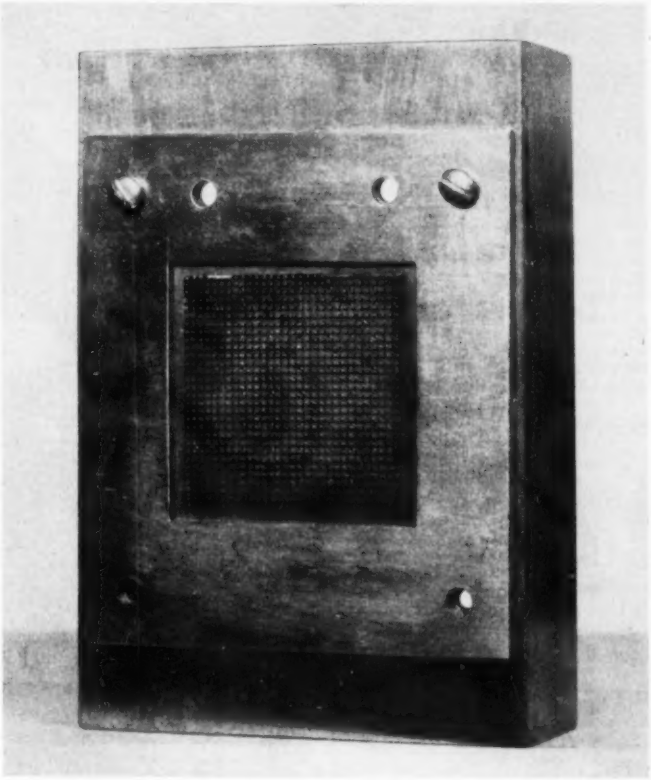
where: V = velocity of propagation, ft./sec.
N = pump speed, rpm.
L = length of spray, inches.
D = degrees of flywheel travel corresponding to the length of the spray.

A device known as a "strobo-disc" is employed to collect samples of fuel from the nozzle at intervals during the injection period. By measuring the volumes of liquids collected during successively known periods, a rate of discharge curve may be obtained.

The device is shown in the sketch in Fig. 2 and in the accompanying photograph. It consists of planetary gearing A, the strobo-disc B, and the collecting tubes C. Nozzle N is mounted on a bracket on casing D, perpendicular to and close to the strobo-disc. For every pump revolution the strobo-disc slot E registers with the nozzle, allowing the spray to pass into funnel F through spout G into the graduated receiving tube H, of which there are 60 located in the cylindrically-shaped "chandelier" C. Waste fuel drains away through spout K.

Phase change is accomplished through the planetary gearing having three shafts. The primary shaft, I, is positively driven from the pump shaft; the secondary shaft II drives the strobo-disc; the tertiary shaft III is manually controlled through a worn wheel drive to change the phase relation between the primary and secondary shafts.

In operation, samples are collected in each of the tubes during a given number of injections proportional to the pump revolutions. For each degree of pump rotation, the volume of liquid collected in the tube is a measure of the rate of discharge. Duration of injection is indicated by the total number of tubes into which fuel is collected. Fig. 3 shows a sample rate of discharge curve.



SPECIAL GRID used in the fuel spray studies

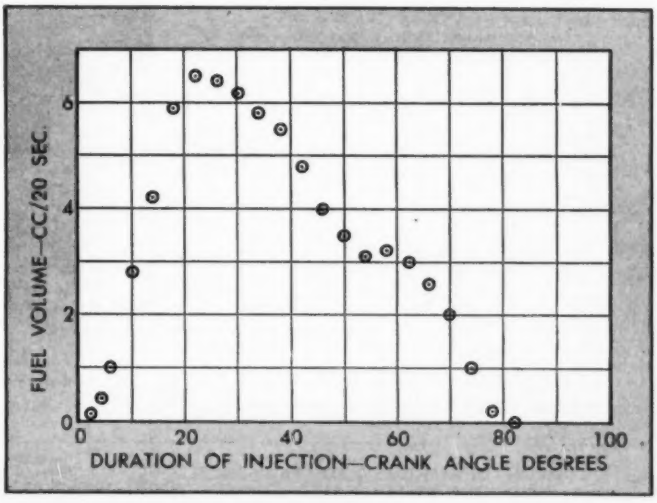


FIG. 3—Typical rate of discharge curve

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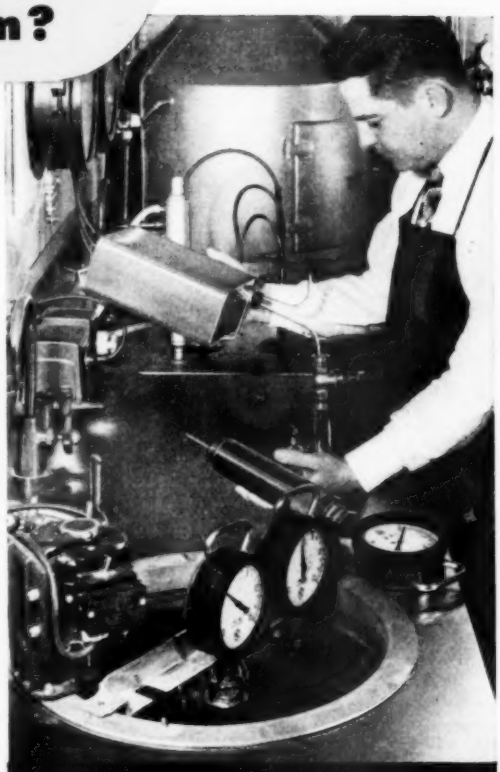

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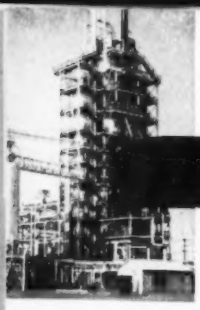

PROCESSING PATENTS

New Developments in Processes and Products

By PETER J. GAYLOR
Editor, "The Technical Survey"

Making Lubricating Oils of Extra High Viscosity Index

ONE of the main activities of oil companies is to develop lubricants which exhibit relatively little change of viscosity over a wide range of temperatures. To obtain oils having viscosity indexes substantially over 100, the usual procedure now is to employ a thickening additive such as polyisobutylene or polyacrylic esters which also raise the viscosity of the base stock.

One patent issued to California Research Corp. (U. S. 2,489,300) describes compositions which exhibit flatter viscosity-temperature curves, within certain temperature ranges, than have been hitherto attained by conventional additive blends. These compositions employ a hydrocarbon base oil, a polymeric material, and a dispersing agent. A desirable fourth component is a stabilizing agent.

The hydrocarbon base oil is preferably one having a low viscosity of 30-110 S.S.U. at 210° F., the more aromatic types (130°-160° F. aniline point) being most advantageous.

The preferred polymeric materials are cellulose ethers of aliphatic alcohols having 1-6 carbon atoms. Among these are ethyl cellulose of at least 45% ethoxyl content, methyl propyl or butyl cellulose or mixed ethers. Certain cellulose esters, polyamides, vinyl polymers and acrylic polymers also may be used. The polymer should be thermoplastic and insoluble or sparingly soluble in the base oil at ordinary temperatures.

In order to stably disperse the polymeric material in the base oil, a dispersing agent such as an oil-soluble polyvalent soap is employed. Aluminum soaps, such as aluminum oleate, stearate or naphthenate, are preferred. The best dispersing agents are the normal or "tri" soaps. The type of acid radical employed in the aluminum soap has a marked influence on the pour point of the product. For example, stearic acid soaps give a high pour point, while aluminum trioleate yields a product of especially low pour point.

Among the stabilizers, ethylene glycol tends to increase the viscosity level of the product. Glyceryl monostearate and monoricinoleate lower the viscosity level and are superior in preventing separation of the components. The stabilizing agent functions to inhibit separation and settling out of the ingredients upon prolonged exposure to elevated temperatures.

A number of blends given as examples of lubricating oils prepared in this manner are given in Table 1. Blend 10, which is not described in Table 1, shows an operating range of 40°-140° F. The viscosity-temperature relations of some of the blends are depicted in graph form in Fig. 1. Inserted alongside the graphs are typical curves for mineral lubricating oils of zero and 100 viscosity index in the temperature range under consideration. It will be observed that considerable improvement is exhibited over 100 V.I. oils in the temperature range of about 100°-200° F.

The compositions are generally cloudy at room temperatures, but have no tendency to separate out over long periods of time. They are stable to milling action and can be blended to give a wide range of properties. It is believed that the polymeric material is neither wholly dissolved in the base oil nor wholly in the dispersed phase. In this range, as the

TABLE 1—Blends of High V. I. Lubricating Oils

Composition (wt. %)	Blend Number 1	2	3	4	5
Hercules ethyl cellulose—N-50 (47.6% ethoxyl content)	..	2.0	2.0	..	2.0
Hercules ethyl cellulose—T-100 (49.4% ethoxyl content)	2.0	..	..	2.0	..
Aluminum dioleate	..	3.0	2.25	..	..
Aluminum soap of hydrogenated fish oil fatty acids (Metavis 540-B)	3.0	..	0.75	..	3.0
Aluminum stearo-oleate (equal parts of stearate and oleate)	..	..	..	3.0	..
Glyceryl monostearate	0.2	0.2	0.2	0.2	0.2
Mineral oil	94.8	94.8	94.8	94.8	*94.8
	100.0	100.0	100.0	100.0	100.0
Viscosity (S.S.U.):					
100° F.	268.2	23,030	503	493	110
130° F.	209.2	31,920	403	529	98
210° F.	270.8	21,080	754	556	108
Pour Point, °F.	+10	<0	−50	−10	+10

* This mineral oil was a blend of sulfuric acid treated distillates from a California wax-free napthenic type crude. The viscosity of the blend was 57.7 S. S. U. at 100° F. and the aniline point was 140° F. This base oil was prepared by selecting a distillate of the approximate viscosity desired in the final oil and treating this lightly with sulfuric acid followed by neutralization with sodium hydroxide to yield the desired aniline point. The oils were then washed and finally given a light clay treatment.

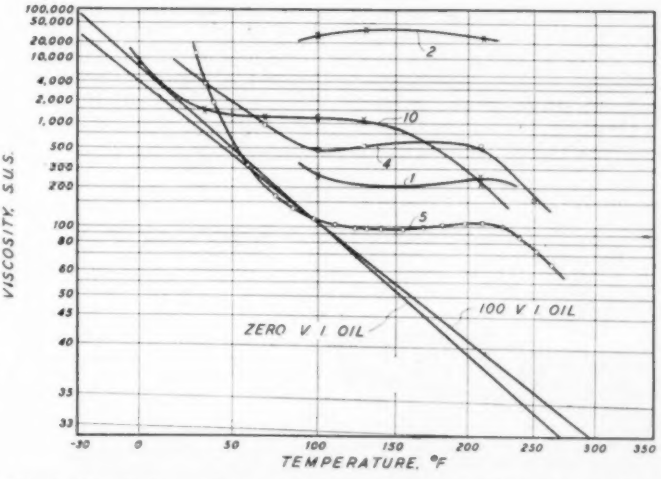

FIG. 1—Viscosity-temperature relationships of Super-VI Blends described in U. S. Patent, 2,489,300

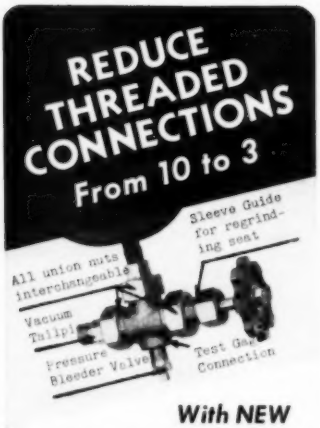

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TABLE 2—Data on Commercial Compounds

Compound	S. S. U. @ 100° F.	Viscosity @ 210° F.	Pour Pt. ° F.	Flash Pt. ° F.	Conradson Carbon
Diethyl phthalate	46.8	31.5	...	275	...
Isopropyl phthalate	59	35	35	275	.003
N-Butyl phthalate	57.5	34	—50	310	.002
N-Amyl phthalate	69	35	35	260	.006
iso-Amyl phthalate	68	35	35	175	.005
Triethyl citrate	72	35	..	305	.290
Tri-o-cresyl phosphate	132	39.4	—20	450	.228
Ethyl oleate	46	33	40	280	.577
N-Butyl stearate	49	34	65	335	.007
Ethyl abietate	1011	60	15	350	.015
N-Propyl adipate	38	30	—30	245	.002
Creosote carbonate	315	40	..	...	...
Glycol phthalate	...	...	..	387	...
Propylated phenanthrene	804	49	..	...	...
Aroclors 1254	2559	47.5	..	405	...
Aroclors 1262	40,000	97	..	...	...
Pine oil	42	...	..	...	...
Hexyl phenyl ether	284	40.4	..	...	...
Dimethyl naphthalene	34	..	..	...	...
Glycerin	579	55	—25	315	.011
Ethylene glycol	58.5	33	— 5	240	.002
Diethylene glycol	75	35.5	—30	250	.012
Propylene glycol	101	35.5	—35	190	.003
Monacetin	186	40	—30	370	.003
Diacetin	69	36	—35	270	.006
Acetylated castor oil	575	81.5	..	...	...
Butylated castor oil	705	92	..	...	...
Acetylated hydrogenated castor oil	815	96.5	..	...	...
Di-sec. butyl sebacate	6.42 cs.	2.09 cs.	—90	355	...
Di-2-ethyl hexyl sebacate	12.64 cs.	3.31 cs.	—90	430	...
Di-undecanyl sebacate	22.53 cs.	4.66 cs.	—85	...	...
Di-2-ethyl hexyl alkylated sebacate	42.72 cs.	5.56 cs.	—45	...	...
Di-2-ethyl hexyl azelate	11.25 cs.	3.05 cs.	—40	410	...

temperature is raised, more of the dispersed polymer dissolves in the oil and thickens it, thus opposing the normal thermal thinning effect. Conversely, as the temperature is lowered, dissolved polymer passes out of solution into the dispersed phase. A more oil-soluble polymer causes a flattening of the V-T curve at lower temperatures than a less oil-soluble polymer. Hence, the greater the solubility of the polymer in the base oil, the lower will be the working range of the blend.

It is possible to add a polar solvent to increase the solubility of the polymer in the base oil. Such solvents may be hydroxy compounds such as 2-butoxy ethanol, butyl lactate, methyl cyclohexanol, etc. About 5-15% may be generally employed.

Hydrocarbon base oils of too high aromaticity may cause some gelling of the product. More viscous base oils require a higher aromaticity than less viscous oils to provide sufficient solvent power for the polymer.

Although this patent is specifically directed to additive blends as outlined above, it presents a novel mechanism which may be applicable to explaining the action of normal hydrocarbon ingredients as well as petroleum lubricants containing polymer V. I. improvers.

Some similar blends have already been discussed in earlier patents[1] in which the unusual results reported might be attributable to a mechanism such as that advanced in the patent discussed in the present article. There is a field open for new blends containing recently developed compounds, particularly as special lubricants and industrial liquids, as has been indicated in some earlier patents.[2] As an aid in the formulation of new compositions of this type, Table 2 is presented giving viscosity, pour, flash, and other data. Of course, it is apparent that other properties such as volatility, corrosiveness, oxidation stability, etc., must necessarily be taken into consideration.

References

(1) U.S. 2,489,281—California Research Corp., Gaylor, PETROLEUM PROCESSING, Oct. 1950, p. 1093; U.S. 2,492,789—Standard Oil Development Co., Gaylor, PETROLEUM PROCESSING, June 1950, p. 643.

(2) U. S. 2,079,783—Standard Oil Development Co.; U.S. 2,204,167—Standard Oil Development Co.

Patents Issued in February

The following classified listing gives the patent number, patentee or assignee, and a brief description of all patents believed to be of direct interest to the petroleum processing industries, as contained in the Official Gazettes of the U. S. Patent Office for February 6, 13, 20 and 27, Vol. 643, Nos. 1-4.

Chemicals

U.S. 2,540,126-7 (Shell Development Co.) Photochemical hydrobromination of olefins.

U.S. 2,540,519 (Standard Oil Development Co.) Continuous sulfonation of aromatic compounds.

U.S. 2,540,559 (Standard Oil Development Co.) Recovery of phthalic and maleic acid.

U.S. 2,540,592 (Standard Oil Development Co.) Plasticized phenolic resin.

U.S. 2,540,596 (Standard Oil Development Co.) Chloroprene polymer vulcanizates.

U.S. 2,540,601 (Standard Oil Development Co.) Molding high wet gel strength diolefin polymers.

U.S. 2,540,938 (Shell Development Co.) N-substituted diamines.

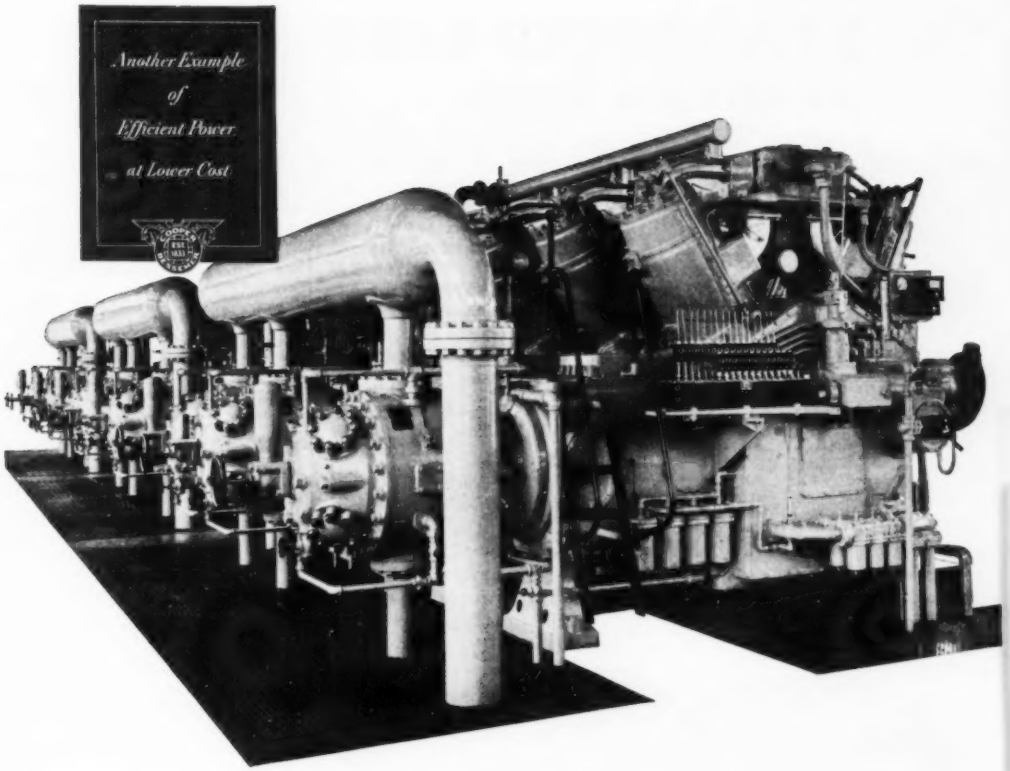
U.S. 2,540,949-50 (Phillips Petroleum Co.) Polymerization of vinylcyclopropane.

U.S. 2,541,027 (Shell Development Co.) Epoxy ethers and phosphorus-containing heat-curable compounds.

U.S. 2,541,148 (Shell Development Co.) Treating coatings of polyallyl esters of saturated fatty acids.

U.S. 2,541,458 (Union Oil Co. of Calif.) Recovery of nitrogen bases.

U.S. 2,541,656 (Standard Oil Development Co.)



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IF you're a technical man, you know that an engine simply converts the heat of fuel combustion into usable motion or power. You also know that there's always unused heat that must be dissipated or somehow disposed of. In sizeable engine installations this can be a big problem, involving lots of costly cooling equipment and valuable space.

Here again, recent Cooper-Bessemer developments are saving money. For example, hundreds of big engines like the Cooper-Bessemers shown above are used to drive compressors on cross-country pipe lines. Because of the Cooper-Bessemer Turboflow and supercharging developments and other advancements, much more combustion heat can now go to produce power, leaving much less waste heat to be dissipated. Thus the cost of cooling equipment, piping and installation can now be reduced by thousands of dollars. It's a huge plus saving over and above the gains of greater fuel economy and increased power.

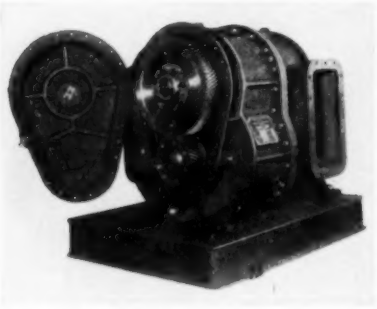
Far-reaching developments like these are constantly being worked out at Cooper-Bessemer. And they're being applied to heavy duty engines for *all* services . . . stationary power, locomotive, marine and other mobile uses. If you have a stake in power, be sure to find out about the *new* things being done by one of America's *oldest* engine builders.

The
Cooper-Bessemer
Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

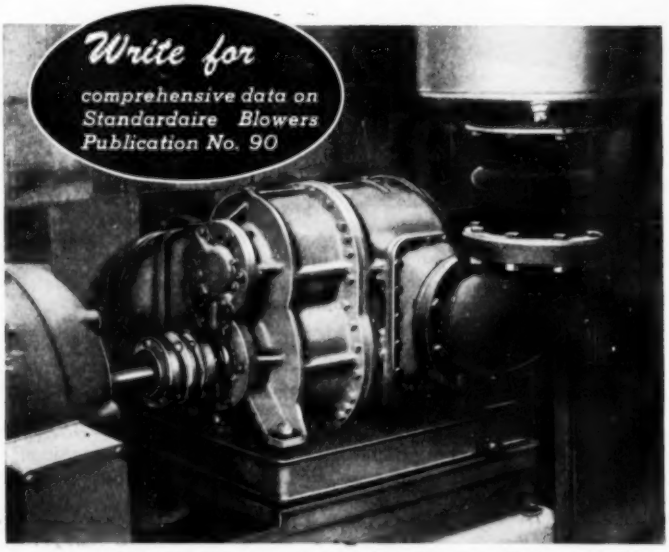
New York, N. Y. Washington, D. C. Bradford, Penna. Parkersburg, W. Va.
San Francisco, Calif. Houston, Dallas, Greggton, Pampa and
Odessa, Texas Seattle, Wash. Tulsa, Okla. Shreveport, La.
St. Louis, Mo. Los Angeles, Calif. Chicago, Illinois Caracas, Venezuela

The STANDARDAIRE
PRECISION BUILT
Axial Flow BLOWER ~



Here's another important design feature of the Standardaire Blower —HEAT TREATED ALLOY STEEL TIMING GEARS—generated and shaved to extreme accuracy for quiet operation.

THESE helical gears keep the cycloidal form, screw type rotors of the Standardaire Blower in timed relation. There is no wind-up in the shafts between the rotors and gears as a very small percentage of the in-put power goes through the timing gears. The male or main rotor does the work and consumes the power; the female rotor acts simply as a valve or gate—further evidence of the finer features found only in the Standardaire Blower. The Standard Stoker Co., Inc. Dept.-E 57-370 Lexington Ave., New York 17, New York.



● Typical installation of a Standardaire Blower as installed in a malting plant.

THE STANDARD STOKER CO • INC •

Standard Stoker SSS

NEW YORK • CHICAGO • ERIE • MONTREAL

Processing Patents

Analyzing substance by mass spectrometry.
U.S. 2,541,673 (Standard Oil Development Co.) Weak-acid isopropanol process.
U.S. 2,541,682 (California Research Corp.) p-Xylene.
U.S. 2,541,959 (California Research Corp.) Separating 3,5-dimethyl 1-ethyl benzene from other ethyl xylenes (by sulfonation).
U.S. 2,542,107 (Pure Oil Co.) Chlorinating saturated hydrocarbons.
U.S. 2,542,111 (Universal Oil Products Co.) Synthetic resins.
U.S. 2,542,370 (Gulf Research & Development Corp.) Thiophosphites.
U.S. 2,542,459 (Standard Oil Development Co.) Copolymerizing isoolefin and multiolefin.
U.S. 2,542,487 (Standard Oil Development Co.) Olefins from oxides.
U.S. 2,542,488 (Standard Oil Development Co.) Olefins from glycols.
U.S. 2,542,520 (Standard Oil Development Co.) Ethylene extraction.
U.S. 2,542,521 (Standard Oil Development Co.) Segregating oxygenated hydrocarbons (using silica gel and methanol).
U.S. 2,542,550 (Standard Oil Development Co.) Esters of polyether acids.
U.S. 2,542,559 (Standard Oil Development Co.) Treating isobutylene polymer slurry to enlarge particle size.
U.S. 2,542,752 (Shell Development Co.) Dehydration of acrolein by stratification and distillation.
U.S. 2,542,772 (Socony Vacuum Oil Co.) High molecular weight carboxylic acids from chlorowax.
U.S. 2,542,832 (Socony Vacuum Oil Co.) Alkyl sulfo-alkenyl phenols and salts.
U.S. 2,542,961 (Shell Development Co.) Chlorine from hydrogen chloride and oxygen.
U.S. 2,542,976 (Shell Development Co.) Producing alkynes from halogenated hydrocarbons.
U.S. 2,542,985 (Houdry Process Corp.) Acetophenone from a-methyl styrene.
U.S. 2,543,016 (Houdry Process Corp.) Polymerizing olefins (32 C).
U.S. 2,543,038 (M. W. Kellogg Co.) Selective hydrogenation of aldehydes.
U.S. 2,543,092 (Sun Oil Co.) Dimerization of vinylcyclohexene.
U.S. 2,543,440 (Phillips Petroleum Co.) Treating polymers produced by alkali metal catalyzed polymerizations.
U.S. 2,543,478 (Phillips Petroleum Co.) Purifying butene-2 of acetylenes with mercury.
U.S. 2,543,575 (Ethyl Corp.) Fractionating chlorinated hydrocarbons.

Refining

U.S. 2,540,083 (Phillips Petroleum Co.) Continuous extractive crystallization process.
U.S. 2,540,129 (M. W. Kellogg Co.) Separating iron from hydrocarbons.
U.S. 2,540,143 (M. W. Kellogg Co.) Separating hydrocarbons from oxygenated compounds.
U.S. 2,540,318 (Anglo-Iranian Oil Co.) Separation of narrow boiling hydrocarbon fractions.
U.S. 2,540,977 (Phillips Petroleum Co.) Continuous fractional crystallization.
U.S. 2,541,069 (Standard Oil Co.—Ohio) Liquid thermal diffusion apparatus.
U.S. 2,541,070-1 (Standard Oil Co.—Ohio) Separating dissimilar components in petroleum products by liquid thermal diffusion.
U.S. 2,541,338-40 (Atlantic Refining Co.) Solvent fractionation of wax-containing mixtures.
U.S. 2,541,380 (Union Oil Co. of Calif.) Solvent extraction of diolefin from monoolefin with diketone.
U.S. 2,541,548 (Phillips Petroleum Co.) Pebble heating chamber for pebble heaters.
U.S. 2,541,990-2,542,013 (Petrolite Corp.) Breaking petroleum emulsions.
U.S. 2,542,147 (Pure Oil Co.) Breaking caustic emulsions.
U.S. 2,542,187 (Warren Petroleum Corp.) Use of glaurin as hydrocarbon stripping liquid.
U.S. 2,542,471 (Standard Oil Development Co.) Removal of peroxides from cracked gasoline by catalytic hydrogenation.
U.S. 2,542,970 (Standard Oil Development Co.) Refining cracked naphthas by selective hydrogenation, using Pt-Pd catalyst.
U.S. 2,543,601 (Foster-Wheeler Corp.) Continuous distillation and treatment of composite liquids.
U.S. 2,543,286 (Sun Oil Co.) Separating hydrocarbons with granular adsorbents.
U.S. 2,543,614 (Sinclair Refining Co.) Selective adsorption of olefins by sulfide of W, Mo, Ni, Co, Fe, or Zn.
U.S. 2,543,489 (Petrolite Corp.) Breaking petroleum emulsions.

Catalysts

U.S. 2,540,689 (Ciba, Ltd.) Coprecipitated alumina-magnesia silica catalyst.

COMPARE

THIS FEATURE

OF THE HONEYWELL SERIES "700" VALVE

ONE-PIECE BONNET

One-Piece Bolted Bonnet of forged steel provides greater ruggedness, simplifies removal for maintenance. Stuffing box is an integral part of bonnet, depth at least six times diameter of stem. Lantern Gland is double packed (top and bottom) . . . added protection against leakage.

✻ Compare the bonnet of this valve with that of any other wide band proportional type. Look at it closely . . . study it feature by feature.

Then check the other features of the valve . . . the Specially Designed Diaphragm, the Duplex Stem Guide, the Packless Bellows Seal, the Safety Stem Lubricator, the wide variety of discs, the easy reversibility in the field.

Your comparison will prove that the Honeywell Series 700 has *all* the features you look for in a fine valve.

It's available in a wide range of styles and sizes. For detailed information, write for a copy of Catalog 700-2, or call in your local Honeywell engineer . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1910 Windrim Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

New Bulletin 750, "Control Valve Sizing Data," is now available

Specially Designed Neoprene Diaphragm

Duplex Upper Stem Guide

Packless Bellows Seal

Safety Stem Lubricator

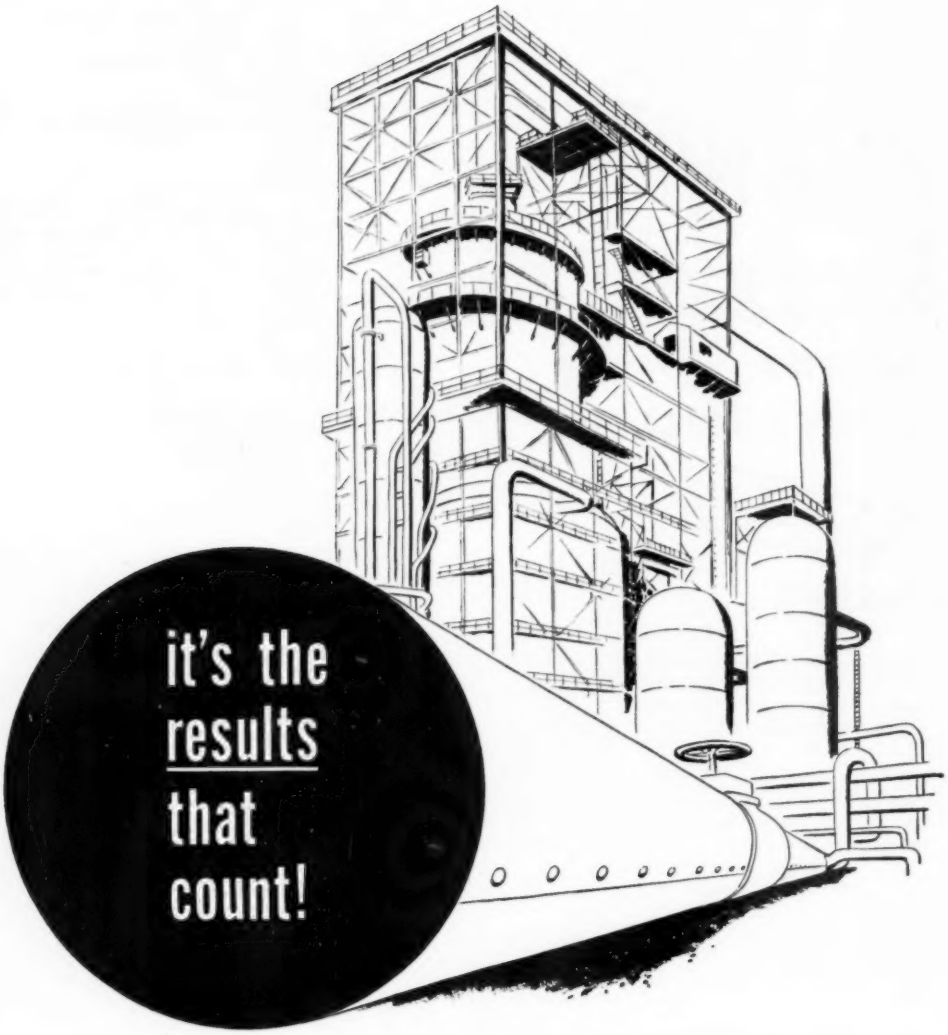
Wide Variety of Discs

Reversibility in the Field

MINNEAPOLIS **Honeywell**

VALVE PRODUCTS

(To obtain more data on advertised products see page 432)



Top results are insured through the uniform quality of Davison synthetic fluid-type cracking catalysts. Years of experience and research make it possible for Davison to better control physical characteristics and maintain chemical purity of their catalysts. Your requirements can now be supplied in either microspheroidal (M-S*) or ground (DA-1*) form . . . both available in various average particle sizes.

The Davison "D" also stands for dependability. Likewise, you can depend on Davison facilities for the development and production of catalysts for your specific processes.

*T.M.T.D.C.C.

Progress Through Chemistry

THE DAVISON CHEMICAL CORPORATION

Baltimore 3, Maryland

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, PHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLUORIDES AND FERTILIZERS

(To obtain more data on advertised products see page 432)

Processing Patents

U.S. 2,541,635 (Standard Oil Development Co.) Recovering catalyst in oil vapors.
U.S. 2,541,801 (Sinclair Refining Co.) Stripping oil from spent cracking catalyst.
U.S. 2,542,610 (Standard Oil Development Co.) Friedel-Crafts double salt catalyst.
U.S. 2,543,069 (Houdry Process Corp.) Preparing hydrogel.
U.S. 2,543,132 (Houdry Process Corp.) Catalyst hydrogel.

Hydrocarbon Synthesis

U.S. 2,540,109 (Phillips Petroleum Co.) Reactivating synthesis catalysts.
U.S. 2,540,581 (Standard Oil Development Co.) Gasoline by carbon monoxide hydrogenation.
U.S. 2,540,587 (Standard Oil Development Co.) Hydrocarbon synthesis.
U.S. 2,540,599 (Standard Oil Development Co.) Catalyst for hydrocarbon synthesis.
U.S. 2,541,654 (Standard Oil Development Co.) Regenerating hydrocarbon synthesis catalyst.
U.S. 2,541,657 (Standard Oil Development Co.) Commercial mixtures of hydrogen and carbon monoxide.
U.S. 2,541,663 (Standard Oil Development Co.) Catalyst for synthesis of hydrocarbons.
U.S. 2,541,677 (Standard Oil Development Co.) Hydrocarbon synthesis.
U.S. 2,541,680 (Standard Oil Development Co.) Reactivation of catalysts containing iron.
U.S. 2,542,422 (M. W. Kellogg Co.) Organic compound synthesis from CO and hydrogen.
U.S. 2,542,454 (The Texas Co.) Manufacturing hydrocarbons and alcohols.
U.S. 2,542,464 (Standard Oil Development Co.) Olefins from CO and hydrogen.
U.S. 2,542,517 (Standard Oil Development Co.) Hydrocarbon synthesis.
U.S. 2,542,558 (The Texas Co.) Regeneration of a cobalt oxo synthesis catalyst.
U.S. 2,543,327 (M. W. Kellogg Co.) Reduced magnetite synthesis catalyst.

Fuels

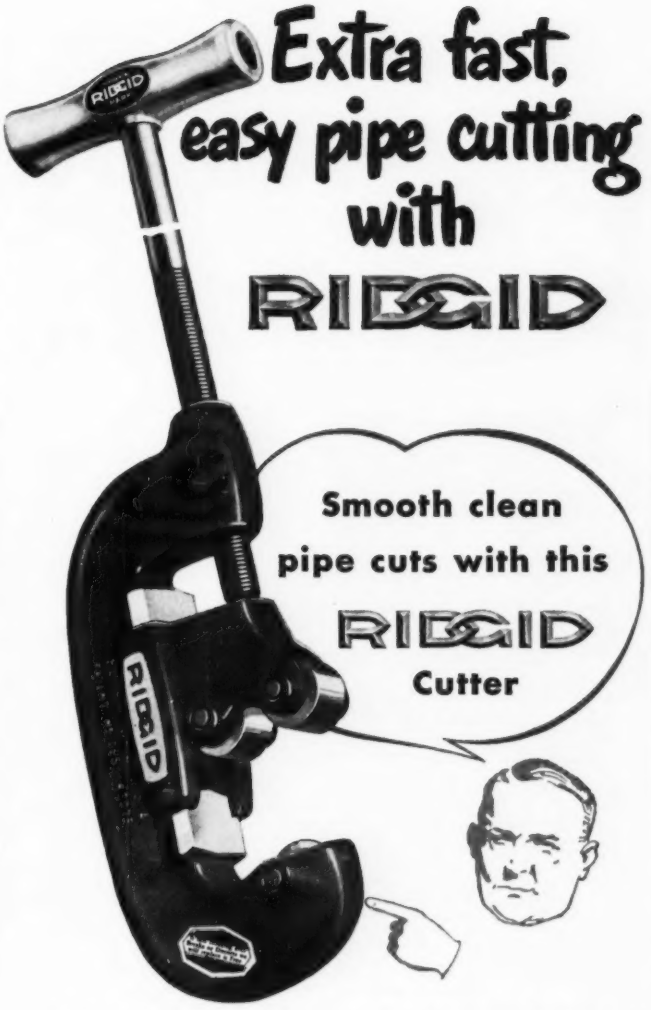
U.S. 2,542,193 (Borg-Warner Corp.) Liquid propellant comprising polynitro paraffin oxidant, nitro-paraffin fuel and thermal stabilizer.

Specialties

U.S. 2,540,800 (Socony-Vacuum Oil Co.) Anti rust agent containing succinic acid derivative.
U.S. 2,541,678 (Standard Oil Development Co.) Fungicidal composition.
U.S. 2,542,608 (Standard Oil Development Co.) Asphalt paint containing phenol extract of cycle oil.
U.S. 2,542,697 (Atlantic Refining Co.) Non ionic detergents from oxidized wax and olefin oxide.
U.S. 2,542,785 (Du Pont) Hydraulic fluid containing di (ethylene glycol) glutarate and isobutanol.
U.S. 2,543,325 (Union Oil Co. of Calif.) Mercaptals, etc. in anticorrosive oil compositions.

Conversions

U.S. 2,540,373 (Universal Oil Products Co.) Apparatus for catalytic conversion of hydrocarbons.
U.S. 2,540,379 (Pan American Refining Corp.) Cracking with hydrofluoric acid catalyst.
U.S. 2,540,582 (Standard Oil Development Co.) Hydrogenation.
U.S. 2,541,044 (Houdry Process Corp.) Catalytic alkylation of aromatics.
U.S. 2,541,077 (Universal Oil Products Co.) Contacting subdivided solid particles with a fluid reactant stream.
U.S. 2,541,186 (Universal Oil Products Co.) Catalytic conversion of hydrocarbons in partitioned tower.
U.S. 2,541,229 (Phillips Petroleum Co.) Catalytic hydrogenolysis of heavy residual oils.
U.S. 2,541,237 (Phillips Petroleum Co.) Hydrogenolysis for production of gasoline and gas oil from residual oils.
U.S. 2,541,267 (Phillips Petroleum Co.) Catalytic hydrocarbon conversion.
U.S. 2,541,317 (Phillips Petroleum Co.) Hydrogenolysis process for production of gasoline and diesel oil from residue stocks.
U.S. 2,541,662 (Standard Oil Development Co.) Controlling flow of solids in a powdered solid and gas contacting operation.
U.S. 2,541,671 (Standard Oil Development Co.) Fluid catalyst for hydrocarbon synthesis.
U.S. 2,541,693 (Dow Chemical Co.) Lower olefins by cracking hydrocarbons, cooling, and passing over oxide of copper or iron.
U.S. 2,541,795 (Sinclair Refining Co.) Catalytic cracking.
U.S. 2,541,882 (Shell Development Co.) Alky-

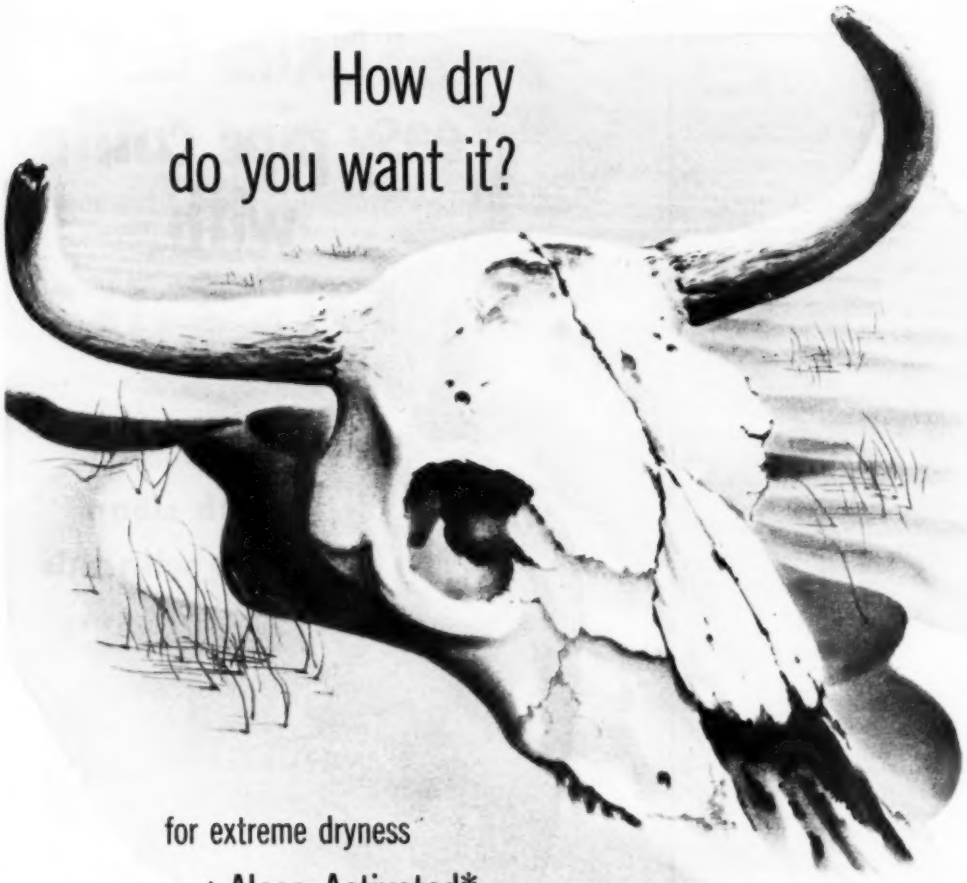


● It rolls right through any pipe with least effort, quick almost burrless cuts—factory tested, tracks perfectly. Special thin-blade cutter wheel for extra fast cutting—or heavy-duty wheel for extra long service. Guaranteed warp-proof special malleable housing. Five models to 6″ pipe; 4-wheel short-handle models for speedy cutting in tight places. For tops in clean easy pipe cutting, buy RIDGID Cutters at your Supply House.

RIDGID
★ Work-Saver Pipe Tools ★

(To obtain more data on advertised products see page 432)

How dry do you want it?



for extreme dryness you need Alcoa Activated* Alumina

Every day more and more petroleum companies are discovering the efficiency and economy of ALCOA *Activated* Alumina for the dehydration of liquids, vapors and gases. They know that it's one of the most effective desiccants they can buy. Dew points as low as *minus 100° F.*—and even lower—can be obtained, and ALCOA *Activated* Alumina can be used for an almost indefinite number of drying cycles.

ALCOA *Activated* Alumina has high resistance to crushing, shock and abrasion . . . will not soften, swell or disintegrate even when immersed in water . . . is non-toxic . . . non-corrosive . . . high in purity . . . practically iron-free.

ALCOA *Activated* Alumina is used to adsorb certain gases and vapors from gaseous mixtures, and serves as a catalyst and catalyst carrier.

What do you dry? How dry do you want it? Whatever your answer, it will pay you to investigate ALCOA *Activated* Alumina. We will gladly send you complete information. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 616D Gulf Building, Pittsburgh 19, Pennsylvania.

** Reg. T.M., Aluminum Co. of America*

FREE—A color print of this illustration on heavy 12" x 18" stock, without advertising matter, suitable for framing. Write us.

Alcoa Chemicals

ALCOA

ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • HYDRATED ALUMINAS • TABULAR ALUMINAS • LOW SODA ALUMINAS ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE • GALLIUM

Processing Patents

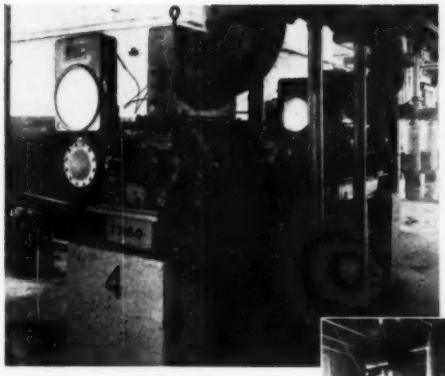
lation of polynuclear aromatic hydrocarbons.
U.S. 2,542,190 (Socony-Vacuum Oil Co.) Alkylation of aromatics.
U.S. 2,542,587 (Sinclair Refining Co.) Vibrating means for fluidized catalyst reactors.
U.S. 2,542,887 (Sinclair Refining Co.) Apparatus for pyrolytic conversion of hydrocarbons.
U.S. 2,542,927 (Phillips Petroleum Co.) HF alkylation.
U.S. 2,543,005 (Socony-Vacuum Oil Co.) Conducting high temperature conversions.
U.S. 2,543,070 (Houdry Process Corp.) Hydrocarbon conversion apparatus.
U.S. 2,543,378 (Records et al) Viscosity breaker and dirt remover.
U.S. 2,543,742-3 (Socony-Vacuum Oil Co.) High temperature conversion of gaseous hydrocarbons.

Lubricants

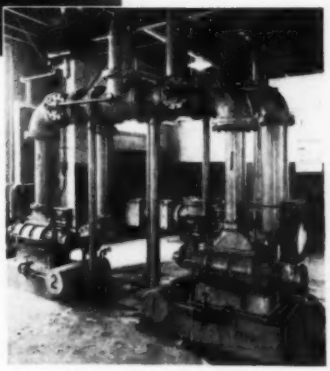
U.S. 2,540,084 (Lubrizol Corp.) Metallic salt of reaction product of phosphorus sulfide and alkylated cycloaliphatic alcohol.
U.S. 2,540,093 (Socony-Vacuum Oil Co.) Thienyl thiol esters in lubricating compositions.
U.S. 2,540,114 (Ward Baking Co.) Sulfonate and ester additives in oils.
U.S. 2,540,533 (Standard Oil Development Co.) Sulfonate grease.
U.S. 2,540,534 (Standard Oil Development Co.) Extreme pressure grease.
U.S. 2,540,570 (Standard Oil Development Co.) Extreme pressure lubricant.
U.S. 2,540,580 (Standard Oil Development Co.) Improved olefin polymer lubricants.
U.S. 2,541,190 (USA) Fluorination of lubricating oil.
U.S. 2,541,599 (Shell Development Co.) Lube oil containing dioctyl phthalate and copolymer VI improver.
U.S. 2,541,686-7 (Monsanto Chemical Co.) Polyallyl myristate or palmitate as pour inhibitors in oil.
U.S. 2,542,159 (Pure Oil Co.) Continuous grease manufacture.
U.S. 2,542,161 (Pure Oil Co.) Mineral oil lubricant containing phosphorized and sulfurized glyceryl trioleate.
U.S. 2,542,286 (Shell Development Co.) Lubricating oil containing chlorinated cyclic polymer.
U.S. 2,542,516 (Standard Oil Development Co.) Lube oil polymer from olefinic naphtha containing oxygenated compounds.
U.S. 2,542,542 (Standard Oil Development Co.) Maleic and anhydride-octadecene copolymer as lube oil additive.
U.S. 2,542,553 (Standard Oil Development Co.) Mineral oil containing additive with S, Cl and oxygen atoms.
U.S. 2,542,570 (The Texas Co.) Sodium myristate ball and roller bearing grease.
U.S. 2,542,604 (Standard Oil Development Co.) Extreme pressure lubricant having phosphate and pentachlorophenol radicals.
U.S. 2,542,831 (Socony-Vacuum Oil Co.) Mineral oil containing stabilizer.
U.S. 2,542,981 (Standard Oil Co.—Ohio) Unsaturated tert-amine-P_2S_5 reaction products as lube oil additives.
U.S. 2,542,982 (Standard Oil Co.—Ohio) Unsaturated amine-sulfur reaction products as lube oil additives.
U.S. 2,543,074 (California Research Corp.) Selenium or tellurium compound stabilized hydrocarbon oils.
U.S. 2,543,542 (Socony-Vacuum Oil Co.) Terpene-mercaptan product as stabilizer for mineral oils.
U.S. 2,543,734 (California Research Corp.) Lubricating oil containing metal phenate or sulfonate and selenomercaptan.
U.S. 2,543,735 (California Research Corp.) Lubricating oil containing selenium or tellurium mercaptans.
U.S. 2,543,741 (Richfield Oil Corp.) Lubricating and sealing composition of flake copper, lead, graphite and petroleum vehicle.

Miscellaneous

U.S. 2,540,261 (The Texas Co.) Measuring wall thickness of curved objects.
U.S. 2,540,310 (The Texas Co.) Integration device for radioactivity measurements.
U.S. 2,540,377 (Standard Oil Co.—Indiana) Apparatus for determining vapor pressure.
U.S. 2,540,416 (Shell Development Co.) Reciprocating liquid fuel burner.
U.S. 2,540,588 (Standard Oil Development Co.) Magnetic testing device.
U.S. 2,540,593 (Standard Oil Development Co.) Melting reduced metal dust.
U.S. 2,541,129 (Automotive & Marine Products Corp.) Vapor top lubricator for motor vehicles.
U.S. 2,541,631 (Standard Oil Development Co.) Impregnated, waterproof, fibrous sheet.
U.S. 2,541,743 (Socony-Vacuum Oil Co.) Particle form solid level indicator.



The four meters illustrated are part of a total installation of nine R-C Meters in a large processing plant. These units measure acetylene gas sold to nearby manufacturers, who also use R-C Meters at the receiving ends. Capacities range from 3,000 cfh to 130,000 cfh.



YOU CAN ALWAYS

trust

R-C METERS

If you're measuring gas for production processes, you can't take any chances on quantities. If you are buying or selling it, you need cash register accuracy. You want equal precision for departmental cost accounting.

The permanent accuracy of R-C Positive Displacement Meters has long been proved for all these purposes by manufacturers and utilities which buy, sell and use gas. Four important reasons account for this unvarying reliability:

1. **Accuracy is not affected by variations in specific gravity, rate of flow, pulsation, moisture, impurities or uncontrollable factors.**
2. **Accuracy is not subject to adjustment of meter or recorder by operators or other persons.**
3. **Accuracy is not affected by reasonable overloads.**
4. **Accuracy is permanent because measuring chambers are surrounded by precision-machined, cast-iron surfaces.**

The 31 standard sizes of R-C Meters give capacities from 4,000 cfh to 1,000,000 cfh. They are extremely compact, permitting installation in cramped spaces. Indicating and recording instruments are available for all types. For whatever purposes you measure gas, you can permanently depend on R-C Meters. Ask for Bulletin 40-B-14 or write us your specific problem.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Texas Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE

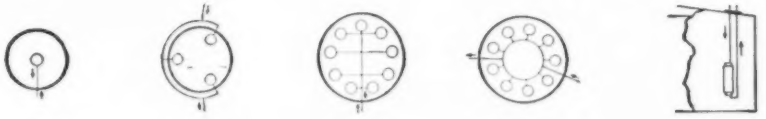
BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

(To obtain more data on advertised products see page 432)

BROWN FINTUBE
Thermo-Flo
TANK HEATERS

easy to install in new—or existing—tankage



Single Heater Installation | Heaters Manifolded on the Outside | Heaters Manifolded on the Inside | Heaters Manifolded on the Inside | Heater Mounted on Roof Manhead

Users report that the cost of a group of Brown Fintube Thermo-Flo Tank Heaters — plus their installation — is less than the cost of just installing a bare pipe heating coil of equivalent capacity.

● Brown Fintube Thermo-Flo Tank Heaters are vastly superior to the old method of heating with a coil of bare pipe installed in the bottom of the tank. Thermo-Flo Heaters mount vertically, practically eliminating any depositing on the tubes. They avoid heating through a layer of sediment, and set up a thermal flow or siphon within the tank that assures thorough, rapid heating, avoiding stratification.

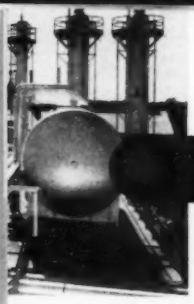
Thermo-Flo Heaters are compact units. They pass through a standard manway with ample clearance. They can be installed quickly; disconnected easily; and cleaned or repaired *outside* the tank.

The TF-20 Heaters, pictured above, have 265 square feet of surface. They are highly endorsed by operating and maintenance men, built in large quantities and are moderately priced. Available in mild steel, stainless steel, monel, inconel, aluminum, admiralty and other non-ferrous alloys to meet any requirement.

Write for Bulletin No. 491. It gives full details.

THE BROWN FINTUBE CO.
ELYRIA, OHIO

FINTUBE HEAT TRANSFER PRODUCTS



EQUIPMENT PATENTS

Brief Reviews of New Inventions in Equipment

Gas-Lift Moving Bed Cracker Constructed in Single Vessel

A SINGLE vessel containing the reaction, regeneration, and stripping chambers, and the elimination of the mechanical elevator for catalyst are said to provide a moving bed catalytic conversion unit with improved overall thermal efficiency, close operating control, and high product yield and quality.

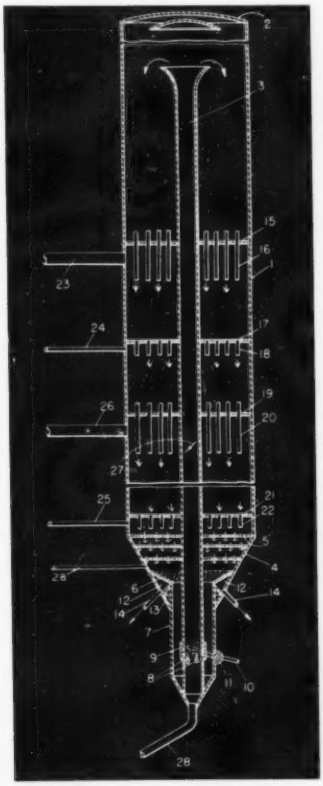


FIG. 1—GAS-LIFT AND SINGLE VESSEL construction feature moving bed catalytic unit (U. S. 2,542,887)

The design arrangement is illustrated in Fig. 1. In operation, the entire chamber comprising the three main zones is filled with catalyst to a level about equal to the top of the catalyst conduit 3. Catalyst may be heated by any conventional means either before or after being charged to the system.

Vapor phase charge oil enters through line 28 and passes up through central conduit 3, carrying with it in suspension catalyst which flows through openings 8 at the bottom of the unit, and the areas of which are regulated by a sliding collar 9 and lever 10. Catalyst and vapor then flow down around the outside of the conduit 3, passing through the various zones via disengaging tubes 16, 18, and 20. At the bottom end of their travel, catalyst fines are separated from the larger particles by means of the truncated, conical wire mesh screen member 6, and leave the vessel via lines 14.

Conversion products from the reaction leave the unit by line 23 following disengagement at the top of the stripping zone, which in turn is fed by sealing and stripping medium, preferably steam, entering via line 24. Regeneration air enters the unit by line 25; flue gas leaves through line 26. Sealing gas at the bottom comes in via line 28.

Operating conditions vary with the nature of the catalyst and the type of reaction. Various types of catalysts can be used. Particle size is, with advantage, of a mesh range of 25 to 40. However, pellets as coarse as 4 to 10 mesh may be employed. Conventional temperature conditions can be followed. Pressure in the reaction zone is preferably 5 to 25 psi, with the pressure differential throughout the system such as to effect proper flow. Pressure drop through conduit 3 may be controlled independently of oil charge, through use of butterfly valve 27.

U. S. 2,542,887, issued February 20, 1951, to K. M. Watson, assignor to Sinclair Refining Co.

Patents Issued in February

The following classified listing covers patents issued during the month of February believed to be of interest or value to petroleum processing or handling operations:

Catalytic Reactors

2,540,373 (Universal Oil Products Co.)—Fluid type catalytic conversion unit, particularly for production of valuable light hydrocarbons such as butadiene and acetylene.

2,540,706 (The Texas Co.)—Catalytic reactor in which moving bed of catalyst is effected by a vertical, helical screw.

2,541,077 (Universal Oil Products Co.)—Catalytic conversion apparatus.

2,541,267 (Phillips Petroleum Co.)—Catalytic conversion apparatus and method.

2,541,662 (Standard Oil Development Co.)—Device for controlling flow of solids in a catalytic unit of the fluid type.

2,542,587 (Sinclair Refining Co.) — Vibrating equipment for use inside the reactor of a fluid type catalytic unit.

2,542,887 (Sinclair Refining Co.)—Moving bed type catalytic unit, using single chamber for both reaction and regeneration, and no mechanical elevation of catalyst.

2,542,951 (Bigelow-Liptak Corp.)—Refractory lined vessel designed for catalytic conversion processes.

2,543,070 (Houdry Process Corp.)—Moving bed catalytic reaction vessel.

Processing, general

2,540,519 (Standard Oil Development Co.)—Apparatus and process for the continuous sulfonation of aromatic compounds.

2,540,883 (Robert C. Hopkins)—Vertical rotary mill for processing refinery acid sludge to a burnable fuel.

2,541,069 (Standard Oil Co.—Ohio) — Liquid thermal diffusion apparatus.

2,541,548 (Phillips Petroleum Co.) — Pebble heating chamber.

2,541,697 (Socony-Vacuum Oil Co., Inc.)—Apparatus for conducting chemical reactions electronically.

2,542,549 (The Thermix Corp.) — Equipment for separating suspended particles from gases.

2,543,001 (Foster Wheeler Corp.)—Continuous still.

2,543,242 (F. A. Kent and C. W. Patrick)—Unit for treating crude petroleum and other liquids.

2,543,378 (E. H. Records and E. L. Records)—Viscosity breaker and dirt remover.

2,543,743 (Socony-Vacuum Oil Co., Inc.)—Apparatus and method for high temperature hydrocarbon conversions.

Instruments

2,540,261 (The Texas Co.)—Device for the measurement of thickness by use of radiation detection.

2,540,310 (The Texas Co.)—Integration device for the measurement of intensity of radioactivity.

2,540,361 (Record R. Whitley) — Adjustable liquid level control.

2,540,377 (Standard Oil Co.—Indiana)—Apparatus for determining vapor pressure.

2,540,444 (American Machine and Metals, Inc.)—Pressure-indicating gage closing switches at selected pressures.

2,540,588 (Shell Development Co.)—Magnetic device for detecting and recording flaws and variations in wall thickness of metal elements, such as structural members, tubular pieces, plates, and rails.

IN FLOW CONTROL EQUIPMENT,

the BEST *is not too good for you*

Why not take advantage of Powell "know-how" in design, workmanship, and *use of materials*?

The Complete Line includes valves in Bronze, Iron, Steel and the widest selection of Corrosion-Resisting metals and alloys ever made available to Industry.

Quality fine throughout "The Line"

Fig. 3003—Class 300-pound, flanged end, Cast Steel O. S. & Y. Gate Valve.

POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

2,540,658 (The Liquidometer Corp.)—Adjustable transmitter condenser for remote metering of liquid level, for example in gasoline storage tanks.
2,540,674 (Mine Safety Appliances Co.)—Portable oxygen analyzer.
2,540,699 (The Weatherhead Co.)—Liquid level gage with deflector, particularly for Liquefied petroleum gases.
2,540,728 (Wheeelco Instruments Co.)—Condition control system with stepped response.
2,540,778 (Bailey Meter Co.)—Furnace combustion control system.
2,540,780 (American Cyanamid Co.)—Ultraviolet spectrophotometer.
2,540,821 (General Electric Co.)—X-ray spectrometer.
2,540,996 (Bailey Meter Co.)—Furnace control system.
2,541,576 (Western Electric Co., Inc.)—Apparatus for determining level of fluent solid particles.
2,541,578 (Manufactures de Produits Chimiques du Nord Etablissements Kuhlmann, Paris, France) — Electrical conductivity cell for measuring flow of a constituent of a gaseous mixture.
2,541,656 (Standard Oil Development Co.) — Apparatus and method for continuous analysis by mass spectrometry.
2,541,743 (Socony-Vacuum Oil Co., Inc.) — Level indicator for catalyst in the reactor hopper of continuous moving bed cracking unit.
2,542,076 (F. J. Stokes Machine Co.)—Vacuum gage of an improved McLeod type.
2,542,168 (L'Air Liquide, Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude, Paris, France)—Liquid level indicator for liquefied gases.
2,542,822 (Westinghouse Electric Corp.)—X-ray thickness gage.
2,542,944 (Interval Instruments, Inc.)—Dew-point meter.
2,543,020 (Paul D. Hess)—Fluid flow meter.
2,543,141 (Office National d'Etude et de Recherches Aeronautiques, Paris, France) — Method for the measurement of pinking in internal combustion engines.
2,543,262 (Combustion Control Corp.)—Burner safety control system.
2,543,522 (Samuel J. Cohen)—Equipment for proportioning liquids.
2,543,558 (Spence Engrg. Co., Inc.)—Boiler safety device.

Valves and Fittings

2,540,371 (Duriron Co., Inc.) — Diaphragm valve.
2,540,467 (Hagan Corp.)—Pilot valve.
2,540,668 (Electric Steel Foundry)—Plug valve.
2,541,176 (Mason-Neilan Regulator Co.)—Control valve.
2,541,968 (W-K-M Co.)—Gate valve.
2,542,127 (General Controls Co.)—Reset valve.
2542,624 (H. John Campbell)—Boiler feed recycling valve combined with a boiler water level control valve.
2,542,969 (Strong Steam Specialty Mfg. Co.)—Steam trap.
2,543,665 (Marvin W. Meierhoff)—Pressure and relief valve arrangement.

Tanks and Vessels

2,540,312 (John H. Wiggins)—Balancing or leveling mechanism for fluid storage apparatus.
2,540,773 (John H. Wiggins)—Balancing mechanism for fluid storage apparatus of the vertically movable type.
2,540,801 (John H. Wiggins)—Secondary seal for floating tank roofs.
2,540,802 (John H. Wiggins)—Sealing structure for floating tank roofs.
2,541,049 (Chicago Bridge & Iron Co.)—Floating roof for storage tanks.
2,541,090 (Chicago Bridge & Iron Co.)—Lifter roof for storage tanks.
2,541,095 (Chicago Bridge & Iron Co.)—Overflow for a spherical liquid storage tank.
2,542,444 (Graver Tank & Mfg. Co., Inc.)—Liquid storage tank and seal mechanism.

Pumps and Compressors

2,540,269 (Tecalemit Ltd., Brentford, England) —Centrifugal pump.
2,540,328 (Charles B. Gray)—Variable flow pump of the reciprocating type.
2,540,733 (The Air Preheater Corp.)—Regenerator for exchanging heat between the working medium and waste gases in a gas turbine cycle.
2,540,968 (Hamilton-Thomas Corp.)—Bearing structure for pump shafts.
2,541,010 (Equi-Flow Inc.)—Gear pump or motor.
2,543,615 (Clark Bros. Co., Inc.)—Gas seal for rotating shafts.

Furnaces, Burners, Accessories

2,540,149 (Foster Wheeler Corp.)—Method for retaining refractory material between spaced tubular members of a furnace.
2,540,416 (Shell Development Co.)—Reciprocating liquid fuel burner.
2,542,029 (Hydrocarbon Research, Inc.) — Water-cooled fluid fuel burner.
2,543,617 (Combustion Research & Development, Inc.)—Liquid and gaseous fuel burner.

Tools

2,540,553 (Chester L. Shobe)—Pipe fitting tool.
2,542,305 (Young Radiator Co.)—Tube beading tool.
2,542,393 (Combustion Engineering-Superheater, Inc.)—Welding equipment for joining pipe.
2,543,007 (F. P. Fitzgerald and A. F. Stieh) —Tube expander.
2,543,012 (Harry J. Glanzer)—Pipe thread plug measuring device.
2,543,430 (Condenser Service & Engineering Co., Inc.)—Plug for sealing tube sheets.

Fire Extinguishers

2,541,554 (American-La France-Foamite Corp.) —Dry powder fire extinguisher.
2,541,751 (Pyrene Development Corp.)—Vapor seal for permanent installations where fire extinguishing fluid is introduced into flammable liquid storage tanks.
2,542,014 (T. B. Edwards and A. L. Donahew) —Fire fighting nozzle.

Free Alcoa's new book "Instrument Lines of Alcoa Aluminum". It's illustrated and crammed with facts. Write today! Address ALUMINUM COMPANY OF AMERICA, 840D Gulf Bldg., Pittsburgh 19, Pa.

Plan to specify Alcoa Aluminum Tube for instrument, air and lubrication lines. It's an excellent performer—corrosion-resistant, light weight and strong. And the initial cost is 40% less than other corrosion-resistant tube. Look under "aluminum" in your classified telephone directory—call your Alcoa Distributor.

Due to rearmament, aluminum is not available for unrestricted industrial use. However, when tubing is used, extensive engineering and planning are required and this advertisement is intended as an aid to your planning.

ALCOA ALUMINUM

ALCOA *Coiled Tube* ALUMINUM

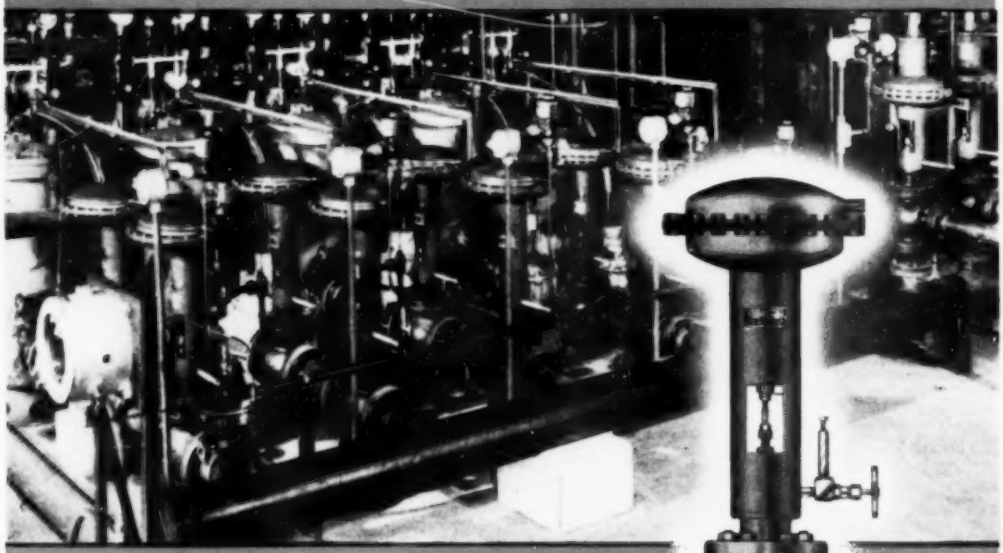
(To obtain more data on advertised products see page 432)

AUTOMATIC CONTROL EQUIPMENT

ENGINEERED DESIGN BY **HAMMEL-DAHL**

SUNOCO

QUALITY *thru* ACCURATE CONTROL *by* H-D



This blending process at Sun Oil Company's new lube oil packaging plant at Marcus Hook Refinery, utilizes this battery of Hammel-Dahl Control Valves.

The versatility of this equipment permits production of a wide range of blends.

HAMMEL-DAHL COMPANY

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ALBANY BOSTON BUFFALO CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON KALAMAZOO KANSAS CITY KINGSPORT, TENN. LOS ANGELES NEW ORLEANS NEW YORK PITTSBURGH SAN FRANCISCO SEATTLE ST. LOUIS SYRACUSE TOLEDO TULSA WILMINGTON, DEL.

In Canada, Railway & Power Engineering Corporation, Ltd

NEWS OF SUPPLIERS

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Dallas Engineering Firm Organized

Tears Engineers, new consulting engineering firm of Dallas, has been formed with Claud F. Tears, Sr., president; Don Horridge, vice-president in charge of mechanical design; C. Fred Tears, Jr., vice-president in charge of process and projects, and G. A. Woods, vice-president in charge of construction. Offices are located at 4617 Cole Ave. Firm will handle all phases of refinery engineering and construction. Its first job, by assignment, is completion of the Moosejaw, Sask. refinery now under construction for British-American Oil Co., Ltd. The second is an extension to an existing HF alkylation unit in an East Coast refinery.

Alloy Steel Names Sales Manager

Mr. Bartlett

Alloy Steel Products Co., valve manufacturers of Linden, N. J., has appointed Harold J. Bartlett as sales manager, with headquarters in the company's home offices. Mr. Bartlett's entire business career has been devoted to the valve industry. After graduation from Armour Institute of Technology, he joined the Crane Co., where he specialized mainly in the development and sale of corrosion-resisting valves and fittings. He was manager of Crane's alloy sales for ten years prior to his new position with Alloy Steel Products Co.

Chlorine-Caustic Plant for Alabama

Mathieson Alabama Chemical Corp., a new, wholly owned subsidiary of Mathieson Chemical Corp., will build a chlorine and caustic soda plant at McIntosh, Ala., about 40 miles north of Mobile. Plant will be located on a 500 to 1000-acre site and utilize salt brine from the McIntosh Salt dome.

Completion is expected by early 1952, with all production expected to be consumed in the Gulf Coast area. Plant will be built by the Chemical Plants Division of Blaw-Knox Construction Co. Officers of the new corporation are Thomas S. Nichols, president; John C. Leppart, executive vice president; Carl F. Prutton, vice president; Stanley de J. Osborne, treasurer; J. V. Joyce, comptroller; and R. I. Galland, secretary.

New Republic Tube Mill for Chicago

Work has been started on a seamless tube mill at the South Chicago Works of Republic Steel Corp., to be the first facility for tubular products manufacture by Republic in the Chicago district. Mill is expected to be in operation by April, 1952.

A certificate of necessity has been granted by the government allowing a major part of the cost of the mill as a defense facility to be amortized for federal income tax purposes over a five year period. The mill will enable the company to produce in excess of 150,000 tons of seamless tubular products per year. Sizes from 2⅜ to 9⅝ in. O.D. will be produced.

Petro-chemical Man Joins Hooker

Dr. Thonet C. Dauphine, who had been associated with Oronite Chemical Co. since 1946 as eastern manager of product development, has been appointed manager of sales development for Hooker Electrochemical Co. at Niagara Falls, N. Y.

Prior to 1946, Dr. Dauphine had been a supervising engineer with California Research Corp. From 1936 to 1939, he was an instructor in chemical engineering at M.I.T., from which school he has two degrees, S.B. and Sc.D. He is a member of numerous professional and engineering societies.

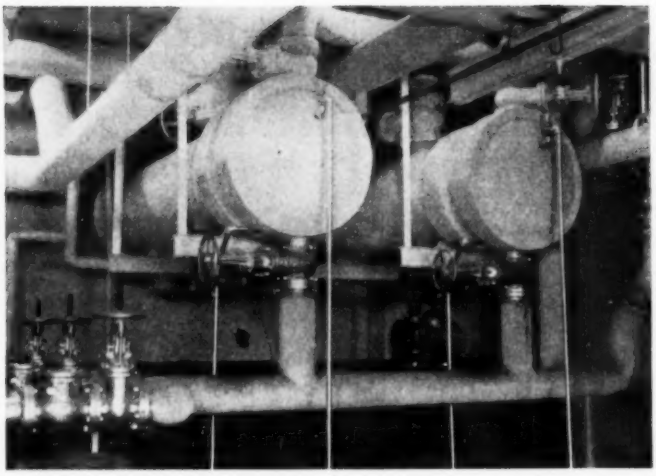
Pacific Pumps Increases NY Staff

Mr. McCormick

J. W. McCormick, a sales engineer for Pacific Pumps, Inc., in the Los Angeles-San Francisco districts since 1948, has been given a promotional transfer to the New York office, 122 East 42nd St. The transfer became effective on the first of March. Mr. McCormick entered the service of Pacific Pumps in 1941 following his graduation from the University of Nebraska. He

Heaviest Refining Unit ever Shipped by Rail Weighs over 300 Tons

Pictured here is the heaviest single railroad shipment ever made from Houston as well as the heaviest piece of petroleum refinery equipment ever shipped by rail anywhere. It is a 49-tray depropanizer, 13 ft. 4 in. in diameter by 120 ft. long, weighing 601,236 lbs. It was fabricated in the Houston plant of Wyatt Metal & Boiler Works. In order to handle this unusual cargo, two specially built railroad cars were used; the middle car serving as an idler to take care of trackage curves.



ADSCO HEAT EXCHANGERS

are "job-selected" for top efficiency!

● It's the job to be done that determines the selection of the proper heat exchanger. Few heat transfer problems are exactly alike and many require special engineering to achieve optimum results. Production is too important these days to permit inefficient operation and needless shut-downs. Insist on equipment built for the job and built to last.

ADSCO has always recognized the need for "tailoring" the equipment to the job. Its engineering department is constantly analyzing heat transfer problems and "job-selecting" the proper heat exchanger for the application. Every recommendation is backed by seventy years of experience in designing, manufacturing and installing steam equipment. Because ADSCO makes all types of heaters in a wide range of sizes, it can deliver the heat exchanger best suited for specific operating conditions.

Consult your ADSCO representative or submit your heating or cooling problem direct for a factory recommendation and quotation.

INSTANTANEOUS WATER HEATERS are furnished as either steam tube or water tube types. Commonly used as instantaneous heaters, booster heaters, convertors, pool heaters or economizers.

STORAGE HEATERS of welded construction in vertical and horizontal types. Removable U-tube element. Wide choice of materials. A. S. M. E. Code stamped when required.

FLOAT HEAD HEAT EXCHANGERS (Also shown in installation picture above) can be furnished with removable tube bundle and with split clamp ring construction for float head. Complete range of sizes to meet all specifications.

AMERICAN DISTRICT STEAM COMPANY, INC. ★ North Tonawanda, N. Y.

(To obtain more data on advertised products see page 432)

served successively as engineering draftsman, test and field engineer, and application and design engineer.

BS&B Appoints Welding Director

Mr. Simms

Howard N. Simms has been appointed director of welding development and quality control of Black, Sivalls & Bryson, Inc., Kansas City, Mo. He will be responsible for the supervision of welding methods and procedures and the establishment and maintenance of quality control of all welded products.

Associated with BS&B since 1936, Mr. Simms has been active in the American Welding Society for many years. He has served as vice president of the midwest district of AWS and is presently a member of the national board of directors of the society. He is also active in the American Society for Metals, the American Society for Testing Materials, and the American Petroleum Institute.

Ryerson Expands St. Louis Plant

Joseph T. Ryerson & Son, Inc., steel distributors, are beginning an expansion program at St. Louis which includes reconstruction and new layout of existing plant and erection of additional warehouse space totalling approximately 50,000 sq. ft. Project will be completed this year. The addition will be built on property lying immediately north of the present plant at 5 Clinton St., where the firm has been in business in the area since 1914.

Brown Instrument Increases Field Staff

Three new industrial managers and 18 additional men have been assigned by Minneapolis-Honeywell Regulator Co. to the field staff of its Brown Instruments Division. Joseph H. Matulis is industrial manager at the Chicago branch, Willard Smith at Pittsburgh, and Joseph H. Bowman at the Buffalo office.

The 18 field men include the following: Merle O. Evers, San Francisco; Frank J. Stevens, Los Angeles; William R. Coffman, Kansas City; Edward I. Espy, Pittsburgh; Robert R. Stalnaker, Denver; Richard G. Daniels, Washington; Cyril L. Griesbaum, St. Louis; Douglas J. Nankervis and Daniel J. Miller, Chicago; Lawrence R. Keenan, East Orange, N. J.; Paul E. McKenzie, Louisville; Donald D. Russell, Twin Cities; Edgar M. Corson, Milwaukee; Harry F. Ogden, Dallas.

In addition, the following field men have been reassigned: Richard B.

Winchester to Rochester; Robert A. Wolfe to Albany; Ed. H. Fiedler to Indianapolis; Louis C. Schultz to Peoria; Clarence W. Swanson to Des Moines; Ralph Brogie to San Francisco; and Fred Akerson to Boston.

NLGI Grants Grease Fellowship

The National Lubricating Grease Institute, Kansas City, Mo., has just announced that a fellowship has been granted to the University of Southern California. Its general scope is to include a study of the fundamental physical and chemical bases of the observed behavior of lubricating greases, according to the Institute. Previous work already done at USC will lead directly in the projects proposed by the fellowship grant.

Hartley V-P at Builders-Providence

Mr. Hartley

John R. Hartley, with the company for 23 years, has been elected a vice president. Manager of project sales for the last three years, he was previously a sales engineer and had begun his association with the company as an apprentice draftsman. Mr. Hartley is a specialist in the fields of water sewage, and industrial waste treatment, and a member of numerous technical societies in those fields. He will continue in charge of engineered project sales both in water and sewage fields and in the problems of water and waste treatment for a variety of industries.

Cummins Uses European Steels

Steel from mills in Belgium and Germany is scheduled for use in maintaining high production levels of Diesel engines by Cummins Engine Co., Columbus, Indiana. Officials of the company have announced the arrival of an initial Belgian steel shipment of 136,000 lbs. at New York.

This a part of orders placed with European mills recently for various types of forging steel and about 75 miles of precision thin wall steel tubing. Cummins explains that these purchases were made only after it became evident that its domestic sources would not be able to supply its current total requirements for certain types of steel.

Personnel Changes

Universal Oil Products Co. — Dr. Herman Pines, a research coordinator, has been appointed associate professor of chemistry at Northwestern University. He is also associate director of the Ipatieff High Pressure Catalytic Laboratory at Northwestern, where he has served since 1941.

Petro-Chem Development Co.—Edward J. Wasp has been appointed chief process engineer of the sales division. He has devoted the last six years to heat transfer, process problems, and furnace design for the petroleum and chemical industries.

Cochrane Corp.—S. B. Applebaum has been named manager of the water treatment division. He was founder and is vice president of Liquid Conditioning Corp., now a subsidiary of Cochrane.

International Nickel Co. of Canada, Ltd.—Dr. John F. Thompson, president, has been elected to the additional office of board chairman. Dr. Paul D. Merica, executive vice president and a director, has been made a member of both the executive and advisory committees of the company.

Monsanto Chemical Co.—John L. Gillis, a vice president and also general manager of the Merrimac Division at Boston, has been named general manager of the organic chemicals division, with headquarters in St. Louis. Charles H. Sommer Jr., of St. Louis, was appointed Merrimac Division general manager to succeed Mr. Gillis.

Heil Process Equipment Corp. — Edwin Vereeke has been appointed sales manager, with charge of all sales and advertising, rising from the position of district sales supervisor. He will make his headquarters in Cleveland at the home offices of the firm.

American Meter Co.—George W. Stevenson, who joined the San Francisco branch of the company in August, 1928, has been made manager of the Los Angeles factory. He had been in the Los Angeles office since 1936, first as a sales engineer and later as assistant manager of the office, until his present promotion.

Young Radiator Co.—Joe C. Shaw, formerly sales engineer at the home office in Racine, Wisc., is now affiliated with the J. R. Meek Co., Tulsa, exclusive distributors of Young products in the Mid-Continent area. Mr. Shaw has been associated with Young since 1942.

GOOD
FOR ALL PRESSURES
Yarway Impulse Steam Traps are suitable for any pressure up to specified maximum *without change of valve or seat.* Types available up to 1500 lbs. Simplifies installation and maintenance. Over 650,000 Yarway Traps already *proved on the job.* Sold by over 200 distributors.
Bulletin T—1740 free.
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Steam Trap
YARNALL-WARING CO. 153 MERMAID AVENUE, PHILA. 18, PA.

(To obtain more data on advertised products see page 432)

API—Refining Division Meeting at Tulsa Will Include 34 Technical Papers

EIGHT technical sessions and 34 technical papers will afford refiners a wide choice of variety at the 16th Mid-Year Meeting of the American Petroleum Institute's Division of Refining in Tulsa, April 30, May 1, 2 and 3.

Topics to be covered include analytical research, refinery waste water, corrosion, electrical equipment, training, and motor fuels. The session on electrical equipment is reportedly the first ever devoted to such equipment in refineries. The two sessions on motor fuels will discuss both gasoline and LPG.

An important feature of some sessions will be Minute Men from the API Department of Safety, who will appear on the platform with a five minute talk involving "Safety or Accident Prevention" as it applies to the activities under discussion.

All sessions will be held in the Crystal Ball Room of the Mayo Hotel in Tulsa. Tickets for the open dinner session being held Wednesday evening, May 2, are $6.00 a person, and API has requested that reservations be made as soon in advance of the meeting as possible. No registration fee is charged for attending any of the technical sessions. A detailed program follows:

Monday, April 30, 9:00 a.m.

ANALYTICAL RESEARCH — E. L. Baldeschwieler, Standard Oil Development Co., presiding:

Two sessions with a total of 17 papers will be presented, sponsored by the Committee on Analytical Research.

Monday, April 30, 2:00 p.m.

ANALYTICAL RESEARCH, Cont. — C. E. Headington, Atlantic Refining Co., presiding.

Tuesday, May 1, 9:00 a.m.

REFINERY WASTE WATER—G. A. Davidson, Standard Oil Co. of California, presiding:

"Chemical Treating Plant for Refinery Waste Water," Hans Schindler, L. Sonneborn Sons, Inc.

"Dissolved Air Flotation Separates Oil from Waste Waters," Nicholas D'Arcy, Huntington Park, Calif.

"Fundamental's and Performance of Gravity Separators—A Literature Survey," Alfred C. Ingersoll, California Institute of Technology.

"Hydraulic Characteristics of Gravity Type Oil-Water Separators," Gerard A. Rohlich, University of Wisconsin.

"Behavior of Oil-Water Mixtures in Gravity Separators—the Photographic Record of Oil-Water Separation Research," a film prepared by the Hydraulics Laboratory, University of Wisconsin.

Safety Minute Man: "Safety in Handling Wastes," S. L. Rankin, Dupont.

Tuesday, May 1, 2:00 p.m.

CORROSION—W. H. Creel, Phillips Petroleum Co., presiding:

"Use of Aluminum in Refinery Equipment," W. E. Baker and E. E. Kerns, Standard Oil Co. (Ohio).

"Corrosion Prevention Program for a TCC Unit Gas Plant," C. A. Murray and M. A. Furth, Pure Oil Co.

"Hydrogen Attack of Steel in Refinery Equipment," J. G. Wilson, R. T. Effinger, M. L. Renquist and A. Wachter, Shell Oil Co.

Safety Minute Man: "Corrosion Hazards," J. B. DeLaune, Cities Service Refining Corp.

Wednesday, May 2, 10:00 a.m.

ELECTRICAL EQUIPMENT—L. M. Goldsmith, Atlantic Refining Co., presiding:

"Explosion Proof Motor Control and Switchgear," B. M. Mills, General Electric Co.

"Explosion Proof Motor Design and Application to the Petroleum Industry," J. Z. Linsenmeyer and C. R. Olsen, Westinghouse Electric Corp.

Safety Minute Man: "Electrical Hazards," Henry W. Boggess, Sinclair Oil & Gas Co.

Wednesday, May 2, 2:00 p.m.

TRAINING TECHNICAL MEN—Harold G. Osborn, Continental Oil Co., presiding:

"Indoctrination Programs for Technical Personnel," F. C. Cutting, Shell Oil Co.

"Industry Practice in Training Technical Personnel," H. G. Vesper and D. H. Etzler, California Research Corp.

"Technical Classrooms on the Job," H. D. Wilde, Humble Oil & Refining Co.

Safety Minute Man: "Safety—A Part of the Technical Man's Training," L. A. Martin, Oklahoma A. & M College.

Wednesday, May 2, 7:00 p.m.

OPEN DINNER SESSION—W. L. Stewart, Jr., Vice President for Refining, API, presiding:

"The Lost Art of Laziness," Stewart Harral, University of Oklahoma.

Thursday, May 3, 10:00 a.m.

FUEL UTILIZATION—C. E. Davis, Shell Oil Co., presiding:

"Economic Relationship of Engine-Fuel Research," C. L. McCuen, General Motors Corp.

Thursday, May 3, 1:30 p.m.

LPG AS MOTOR FUEL—Ross W. Thomas, Phillips Petroleum Co., presiding:

"LP-Gas, Over a Million Barrels Daily," R. C. Alden, Phillips Petroleum Co.

"The LP-Gas Industry's Progress in Meeting Its Distribution Challenge to Old and New Markets," Howard E. Felt, Warren Petroleum Corp.

"Use of LPG as Tractor Fuel," Ernest Fannin, Fannin's Gas & Equipment Co.

"The Propane Story," Robert S. Lee, Twin Coach Co.

"Relative Economies of LPG, Gasoline and Diesel Fuel in Trucks and Buses," Eugene S. Corner, Standard Oil Development Co., and E. H. Berg, Esso Standard Oil Co.

ASME—Industrial Wastes

VARIOUS aspects of the industrial waste problem will be discussed at the American Society of Mechanical Engineers 2nd Process Industries Conference to be held in Baltimore, Md., April 17, 18 and 19. Papers on the program will cover both air pollution and liquid wastes, and will include such topics as instrumentation as applied to industrial wastes, a survey of state legislation on water pollution, and the utilization of pollutive wastes.

NPA—Additives for HD Lubes

PRESENT and future trends in additives for "Heavy Duty Type" lubricating oils will be the subject of a panel discussion to be held during the 48th semi-annual meeting of the National Petroleum Assn. in Cleveland, April 18, 19 and 20. The panel discussion will headline the joint

Nicholson Steam Traps Require

NO CHANGE of VALVE or SEAT, 0 to 225 Lbs.

Nicholson steam traps save the time and trouble of adjusting valves for varying pressures. This feature substantially speeds production and maintenance. Made of hardened stainless steel, the valve is extra large, resulting in from 2 to 6 times average drainage capacity. Both valve and seat are renewable. The fast action of Nicholson traps prevents waterlogging. Installations have frequently increased production of cooking kettles, for example, as much as 30%. Eliminate "cold blow" in unit heaters. 5 types for every application. Size ¼" to 2"; press. to 225 lbs.

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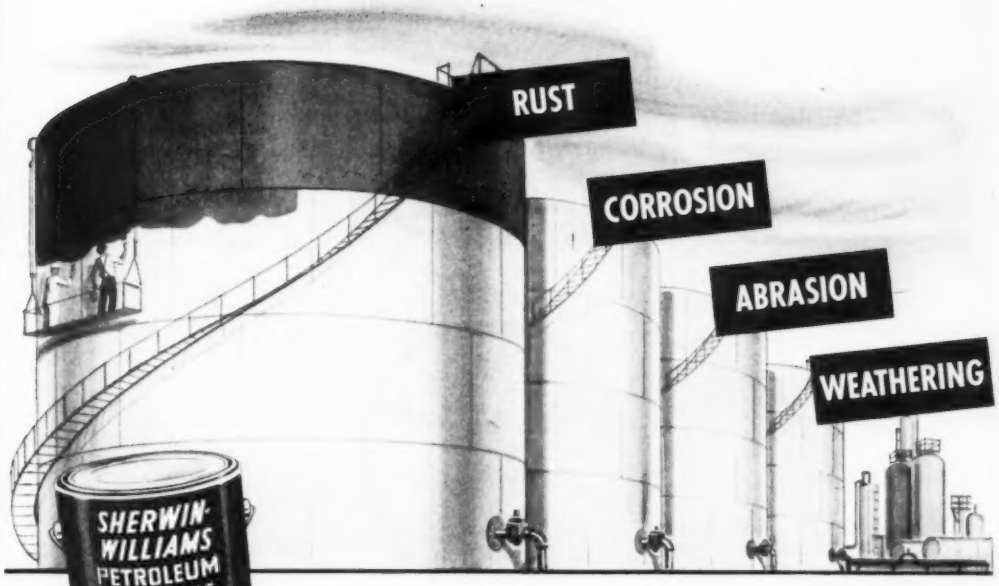

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- **PENETRATES** into joints and rivet holes.
- **PREVENTS** rust and corrosion.
- **PROTECTS** against abrasion, with tough, elastic film.
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It takes a *multiple-pigment primer* to protect metal surfaces against *all four* destructive forces of rust . . . corrosion . . . abrasion and weather. It takes a combination of pigments, too, to produce a primer that is easy to apply by brush or spray, and that will store indefinitely without becoming unusable, as well.

That's why Sherwin-Williams KROMIK—the 4-PIGMENT primer—has proved itself for many years the ideal metal primer for heaviest-duty use in general industry, structural steel work and railway and marine service, as well as for protection of petroleum equipment.

KROMIK combines the best protective properties of red lead pigment with those of three other pigments—zinc chromate, zinc oxide and iron oxide. Get the facts today—ask your Sherwin-Williams representative about KROMIK and other S-W finishes for petroleum equipment, or write The Sherwin-Williams Co., 101 Prospect Avenue, Cleveland 1, Ohio.

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PETROLEUM FINISHES

(To obtain more data on advertised products see page 432)

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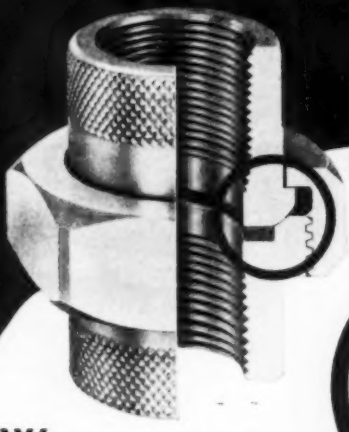

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Seal

Weco "Junior" unions give you a plus value for extra long service and repeated make-up and break-out without danger of leaks. It's the replaceable gasket which protects the famous Weco ball-and-cone seal from corrosive or abrasive action of line fluids and gases. It prevents the possibility of turbulence in the space between the sub ends. With this protection the ball-and-cone seal and union retain their original tightness and leak-proof far beyond normal expectation. The gasket material is chosen from virtually all standard gasket materials, thus the Weco "Junior" is applicable for a wide range of services.

The Weco "Junior" has heavy acme threads for faster, easier starting . . . easy break-out. They will not seize. The walls of the sub-ends are heavier and stronger than usually found in unions of this type.

Weco "Juniors" are 3000 lb. non-shock, C.W.P. unions, available in sizes ⅛" through 2" with machine finish or Weco-lyte Cadmium Plated.

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Weco "Junior" Unions are packed in cartons of 12 (1¼" and larger) and 24 (1" and smaller). This added feature protects the union . . . makes them easier to stock . . . simplifies inventorying.

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Subsidiary of Chiksan Company
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Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

Meetings

meeting Friday morning, April 20, of NPA's Departments of Manufacture and of Standards and Tests.

According to NPA, it is expected that some of the results of two surveys now being conducted on lube oil additives will be available for discussion at this meeting. One survey is being conducted by the Petroleum Committee of the Munitions Board to determine military requirements, and the other by the Petroleum Administration for Defense to learn the availability of additives and the needs of the oil industry.

OIL MAN'S CALENDAR

APRIL

16-18, American Society of Lubricating Engineers, National Convention, Bellevue-Stratford Hotel, Philadelphia.

17-19, American Society of Mechanical Engineers, 2nd Process Industries Division Conference, Lord Baltimore Hotel, Baltimore, Md.

17-20, Packaging Institute, 20th Annual National Packaging Exposition and Annual Conference on Packaging, Packing and Shipping, Auditorium, Atlantic City, N. J.

18-20, National Petroleum Assn., 48th Semi-Annual Meeting, Hotel Cleveland, Cleveland, Ohio.

19, Petroleum Committee of Packaging Institute, committee meeting following Technical Committees Luncheon, Ritz-Carlton Hotel, Atlantic City, N. J.

20-21, 17th Annual Engineers' Day, Colorado School of Mines, Golden, Colo.

23-24, Industrial Accident Prevention Assn., Annual Accident Prevention Convention, Royal York Hotel, Toronto, Ont.

25-27, Natural Gasoline Assn. of America, Annual Meeting, Mayo Hotel, Tulsa.

29-May 2, American Assn. for the Advancement of Science, Southwestern Division Meeting, Texas Western College Campus, El Paso, Texas.

30-May 1, Chemical Specialities Manufacturers Assn., 37th Mid-Year Meeting, Hotel Drake, Chicago.

30-May 3, American Petroleum Institute, Division of Refining, Midyear Meeting, Mayo Hotel, Tulsa.

30-May 4, 4th National Materials Handling Exposition, International Amphitheatre, Chicago.

30-May 11, British Industries Fair, Castle Bromwich, Birmingham, England.

MAY

6-10, Air Pollution and Smoke Prevention Assn. of America, Annual Convention, Roanoke, Va.

7-10, Liquefied Petroleum Gas Assn., 20th Anniversary Convention and Trade Show, Stevens Hotel, Chicago.

7-11, The Greater New York Industrial Show, 71st Regiment Armory, 34th St. & Park Ave., New York.

13-16, American Institute of Chemical Engineers, Regional Meeting, Hotel Muehlebach, Kansas City, Mo.

23-24, American Society for Quality Control, 5th National Convention, Public Auditorium, Cleveland.

28-June 6, Third World Petroleum Congress, The Hague, Netherlands.

JUNE

2, California Natural Gasoline Assn., June Frolic, Rio Hondo Golf Club, Downey, Calif.

3-8, Society of Automotive Engineers, summer meeting, French Lick Springs Hotel, French Lick, Indiana.

18-22, American Society for Testing Materials, 54th Annual Meeting, Atlantic City, N. J.

JULY

4-14, British Instrument Industries Exposition, National Hall, London.

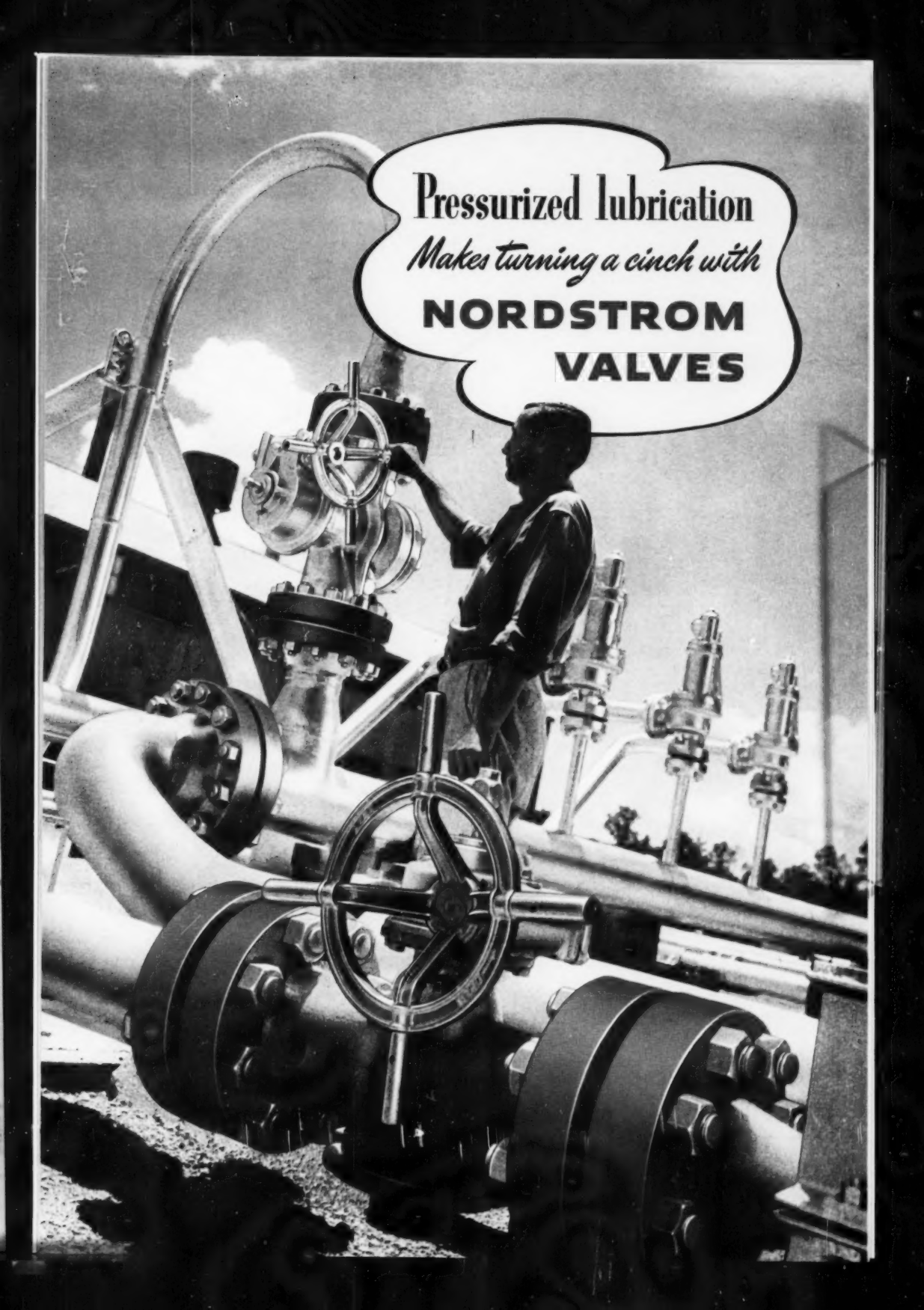
AUGUST

13-15, Society of Automotive Engineers, West Coast meeting, Olympic Hotel, Seattle, Wash.

SEPTEMBER

3-7, American Chemical Society, Diamond Jubilee meeting, Hotel Statler, New York City.

9-13, 12th International Congress of Pure and Applied Chemistry, Hotel Statler, New York City.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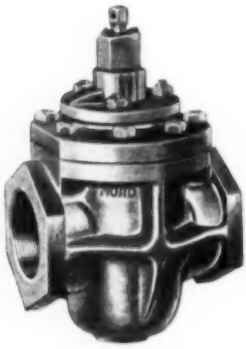
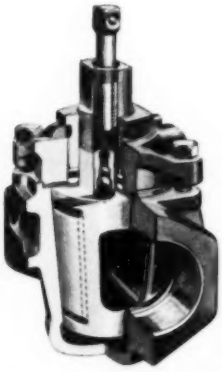
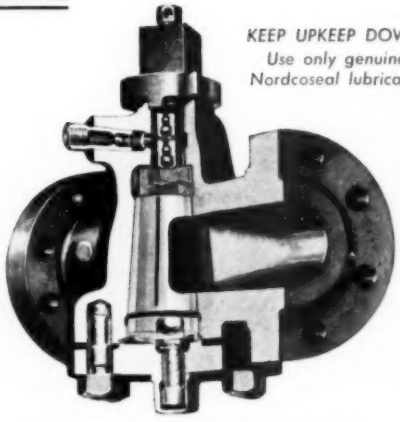


STANDARD TYPE, *Bolted Gland*



STANDARD TYPE, *Screwed Gland*



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BOOK REVIEWS

New Manual Is Published On Measuring and Sampling

ASTM Manual on Measurement and Sampling of Petroleum and Petroleum Products. December, 1950; 6 x 9 in., 132 pages, illustrated, in heavy paper cover, $2.00; in cloth cover, $2.65. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna.

This new *ASTM Manual* makes available in one place recommended methods for measuring the volume, or weight, of petroleum and its products, and for obtaining representative samples. Included are ASTM methods of gaging, temperature measurement, and sampling; a recommended practice for volume calculations and corrections; and tests for water and sediment by centrifuge, and gravity by hydrometer. There is also a proposed method for sampling liquefied petroleum gases.

Well illustrated and simply written, the book will be particularly useful to plant men, transportation men, sales and marketing department personnel, and to many consumers of petroleum and its products. It represents the results of some ten years of work by Division II on Measurement and Sampling, of Committee D-2 on Petroleum Products and Lubricants.

Committee D-2 Study Covers Lower Boiling Hydrocarbons

Physical Constants of Hydrocarbons Boiling Below 350 F., STP No. 109; 8½ x 11 in., 16 pages, heavy paper cover, $1.00. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna.

This extensive compilation of tables includes most of the physical constants of hydrocarbons (boiling below 350° F.) which would be valuable to engineers concerned with the natural gasoline, synthetic rubber, industrial aromatics, and gaseous fuels industries.

Six classes of hydrocarbons are covered, including paraffins, monoolefins, di-olefins, acetylenes and naphthenes, and aromatics. Only those having good freezing point data were included in the tabulations, on the assumption that others had not been prepared in sufficient purity. Experimental data from the literature, when available, were used and bibliographical references and keys were prepared to show sources. In some cases it was necessary to estimate.

Specifically, the tables cover: name, formula, molecular weight, boiling point, vapor pressure, freezing point, the three critical constants, liquid densities (in four systems of units), gas density (in three forms), specific heats (at constant pressure and volume), ratios of specific heats and liquid specific heats, gross and net calorific values, heats of vaporization, refractive index at two temperatures, air required for combustion, inflammability limits, aniline point, and octane number by two methods. The data on 225 compounds are tabulated.

The values in the tables represent what are thought to be the best appearing in the literature up to May, 1950. It is planned to keep the tables up to date with the issuance of complete revisions about once every five years.

The work was directed and much of it carried out by Robert Matteson, California Research Corp., working with Technical Committee H on Light Hydrocarbons, of ASTM Committee D-2 on Petroleum Products and Lubricants. He was assisted by George R. Lake, Union Oil Co. of California; C. O. Hurd, Shell Development Co.; and W. S. Hanna, California Research Corp.

Ion Exchange Mechanism and Applications Are Described

Ion Exchange Resins, by Kunin and Myers; 5⅝ x 9 in., xii + 212 pages, indexed, illustrated, stiff cloth binding, $4.75. (1950). John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y.

A rapidly growing trend in interest and in the use of the ion exchange mechanism as a method of chemical processing, particularly over and beyond its conventional employment in water conditioning, has prompted the writing of *Ion Exchange Resins*. Recently, for example, the ion exchange phenomenon has been suggested and studied in connection with fractionation techniques. Although it has not yet been clearly established, there is some evidence that the catalytic activity of some clay and synthetic silicates in petroleum processing and cracking centers about the exchangeable hydrogen ions present. Scattered work is being done today on the use of ion exchange materials in the form of resins for catalysis of organic reactions of various types. It is therefore apparent that a book like the present one is a needed piece of literature.

The book is broken down into twelve chapters dealing with the following major topics: theory and mechanism of ion exchange, cation

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HEAVY-DUTY SIDE ENTERING MIXERS
Let Eastern's engineers help you with your petroleum processing equipment problems. Without obligation to you—they will propose suitable mixing equipment and guarantee its satisfactory performance.
These rugged and dependable side-entering mixers prevent settling and bottom-precipitation. Available motor ratings ⅛—30 H.P. Speeds from 280—1725 R.P.M. Repackable while tank is full.
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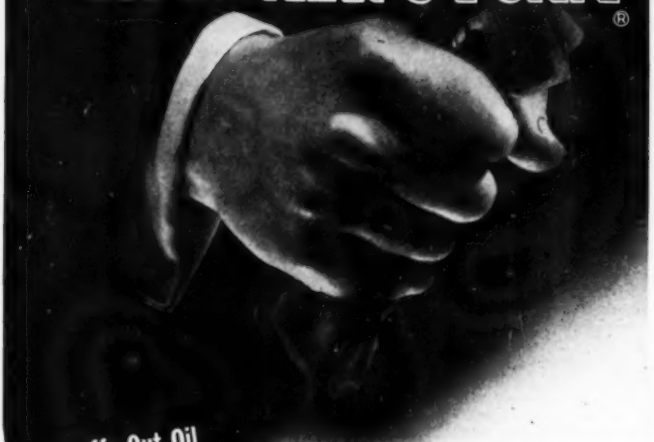
(To obtain more data on advertised products see page 432)

GET A GRIP ON FIRE PROTECTION COSTS

Use 3% AER-O-FOAM®



Snuffs Out Oil and Gasoline Fires —FAST!

Actual dollar savings is one of the many advantages you gain by using 3% Aer-O-Foam Liquid. That's because half as much of it produces as much foam as a same amount of the regular 6% concentrate . . . at less cost.

This is not the only way you save money with 3% Aer-O-Foam. Besides lowering foam costs, it cuts in half storage space requirements, thereby reducing handling time and shipping space needs.

Fights Fires Better

Laboratory tests prove Aer-O-Foam gives better all-around performance than other brands of 3% Liquid. Let it do the same for you. Specify and insist on 3% Aer-O-Foam Liquid.

HERE'S PROOF

Actual laboratory tests figures prove 3% Aer-O-Foam gives better performance.

	Foam Expansion at 70°F (Gallons of foam per gallon of solution)	Minimum Operating Temperature*, °F.	FIRE TEST in accordance with nationally recognized standards				
			Coverage (Minutes)	Control (Minutes)	Extinguishment (Minutes)	Vapor Sealing Ability (Minutes)	Burn-Back Area** (Inches square)
3% Aer-O-Foam Liquid	10.25	0	0.80	1.66	2.25	20.0	10
Brand "Y"	9.00	6	1.33	4.00	4.33	6.5	19
Brand "Z"	8.50	14	2.50	4.33	5.17	2.0	30

*Temperature below which foam liquid viscosity increases so that pick-up rate is too low.

**A six-inch square hole is cut in blanket, reignited and permitted to burn for five minutes. The extent of increase of exposed surface is then measured.

NATIONAL FOAM SYSTEM, INC.
Headquarters for Foam Fire Protection
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Book Reviews

and anion exchange resin characteristics, synthesis of ion exchange resins, applications, water softening, miscellaneous applications, equipment. An extensive bibliography of some 615 literature references is included.

The authors are associated with Rohm & Haas Co., Robert Kunin as Laboratory Head, and Robert J. Myers as a research supervisor. Dr. Kunin received his B.S. and Ph. D. from Rutgers and began his career as a chemist with the TVA. Before joining Rohm & Haas he was with the Manhattan Project and worked as an industrial fellow with the Mellon Institute, where he dealt with the relationship of ion exchange properties of silicates and their catalytic properties. Dr. Myers received a B.S. from Creighton University and Ph. D. from Johns Hopkins. He was a research associate at Johns Hopkins Hospital for one year and at the University of Chicago for two years. Since 1937 he has been employed by Rohm & Haas.

British Petroleum Institute Issues 11th Edition of Tests

Standard Methods for Testing Petroleum and Its Products, 11th Edition, 1951; 5½ x 8½ in., xix + 724 pages, paper binding, 31s. 6d. The Institute of Petroleum, 26 Portland Place, London, W.1, England.

The steady increase in the number of petroleum products and their properties is reflected in the increase in size of this latest edition of the British Petroleum Institute's *Standard Methods . . .*, which contains 64 pages more than its immediate predecessor, which was published in late 1949. Nine new methods of test are included: they are:

Aromatic content, bromine number, bromine number—electrometric titration, distillation of hydrocarbon gases—low temperature fractionation, drop point of greases, foreign particles in greases, melting point of petrolatum, residue on evaporation—motor fuel and kerosene, and rust preventing characteristics—steam turbine oil. In addition, 33 standard methods and five specifications have been revised and brought up to date.

Other Recent Books

NFPA Inspection Manual; 4 x 6½ in., 336 pages, cloth bound, illustrated, (1950) $3.00. National Fire Protection Assn., 60 Batterymarch St., Boston 10, Mass. A new pocket manual for fire inspectors, replacing the earlier NFPA inspection book, Field Practices (1914-1929).

Statistical Engineering in the Chemical Process Industries, Abstract of Selected Articles, Series One; Statistical Engineering Division, R. S. Aries & Associates; 5½ x 8½ in., 48 pages, paper bound, $2.00. Chemonomics, Inc., 400 Madison Ave., New York 17, N. Y.

(To obtain more data on advertised products see page 432)

STRESS CONCENTRATIONS BANISHED when you use this stud

There's no doubt about it—stress concentrations cease to be a factor when you put the Bethlehem Continuous-Thread Stud to work in high-temperature, high-pressure bolting jobs in refineries.

The Bethlehem Continuous-Thread Stud is free of stress concentrations because there is no point of thread runout anywhere on the surface of the stud. Therefore, stresses can't possibly concentrate at any one point. Instead, they are effectively distributed over the entire length of the stud. Premature stud failure becomes virtually impossible, resulting in long service-life.

The Bethlehem Continuous-Thread Stud is made from high-quality carbon or alloy steels. It comes plain or heat-treated in a wide range of diameters, and in any length. All commonly used sizes are carried in stock for prompt shipment.

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Bethlehem supplies every type of Fastener

Six reasons why the major steel companies are using McKee Engineering Services

1 Arthur G. McKee & Company have been recognized since 1905 as a leading engineering firm engaged in the design, engineering and construction of iron and steel plants.

2 McKee experience includes all types of iron and steel production facilities from preparation of raw materials to finished steel.

3 The McKee organization has the scope and resources to undertake any steel plant project regardless of size or location. Completion dates of new projects are contingent on present schedules.

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6 Men in the Iron and Steel Industry know from long experience that the McKee method of coordinated engineering reduces plant costs and speeds completion—that ***McKee Engineering means Assured Results.*** That's why they buy McKee Engineering.

MEMO TO
Petroleum Refine

● This advertisement is published here to acquaint oil men with what the McKee Iron and Steel Plant Division is doing to alleviate steel shortages.

In addition to its refinery engineering projects McKee now has in progress seven blast furnaces, two integrated steel plants, two 750,000-ton open-hearth shops and miscellaneous related projects.

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Headquarters: McKee Building, 2300 Chester Avenue, Cleveland 1, Ohio. *New York:* 30 Rockefeller Plaza, New York 20, N.Y. *Tulsa:* 918 First National Bank Building, Tulsa 3, Okla. *England:* The Iron and Steel Division of Arthur G. McKee & Company, is represented by Head, Wrightson & Co., Ltd.

REFINING TRENDS

Current Data on Crude Runs, Product Supply and Demand

First Quarter Demand for Products Is Running Ahead of the Forecasts

TOTAL runs of crude to refinery stills for the first quarter of '51 are indicated as around 6,400,000 b/d avg. This is about 5% higher than the 6,100,000 b/d avg. runs to stills forecast for this period by the Bureau of Mines. In fact, it is higher than the forecast of runs for any quarter this year. Runs for the first 3 months are about 18% above the average 5,400,000 b/d runs for the first quarter of 1950, which of course was before the increase in refinery activity which started with the invasion of Korea.

The continued high rate of runs to stills for the year thus far means that refineries continue to operate at close to their rated capacity, around 95% for the whole country, in the latter part of March. Since plants in California are operating at under 90% of capacity, the rate for some other districts is higher than the country-wide average. As reported by the API, the Ind.-Ill.-Ky. and the Louisiana Gulf districts late in March were running crude at over 100% of their plants' rated capacity.

The current rate of refinery operations reflects the high volume of product demand at the plants, which also is above forecast demand for the major products. Indicated motor fuel demand at refineries for the first quarter is around 2,700,000 b/d avg., as compared with forecast demand of 2,620,000 b/d avg. Average daily demand for motor fuel the first quarter of '51 is about 12% higher than for the first quarter of 1950.

Heating oil demand for the first quarter this year, around 2,170,000 b/d avg., compares with 2,030,000 b/d avg. forecast demand, and it is about 16% higher than daily average demand for the first quarter of 1950.

Residual fuel oil demand for the first 3 months of '51, around 1,825,000 b/d avg., is about 6% above the forecast demand for the same period of 1,722,000 b/d avg., and it is about the same rate higher than demand for heavy fuel oil in the first quarter of 1950.

The fact that indicated product demand at refineries is running ahead of forecast demand makes it difficult to evaluate product stocks in terms of coming consumption. Gasoline stocks (141,239,000 bbls. on March 24) represent 44 days of consumption based on forecast demand for the second quarter of the year. Actually they are probably fewer days' supply, since motor fuel consumption is running ahead of the earlier estimates of demand. The less than 44 days' supply represented by March 24th gasoline stocks compares with 45 days' supply of actual refinery demand for stocks on March 31, 1950, and 47 days' supply in 1950.

In volume, gasoline stocks on March 24 (141,239,000 bbls. for the entire country) compare with 132,796,000 bbls. on March 31, 1950. Stocks east of California were 123,932,000 bbls. on March 24 and 113,610,000 bbls. March 31, a year ago.

Heating oil stocks (kerosine and distillate) were 56,568,000 bbls. on March 24, as compared with 50,778,000 bbls. on March 31, a year ago. This volume represented 49-50 days' supply of refinery demand as forecast for the second quarter of this year, but probably fewer days' supply in terms of coming actual demand. Stocks on March 31, '50, were 49 days' supply and on March 31, 1949, they were 79 days' supply.

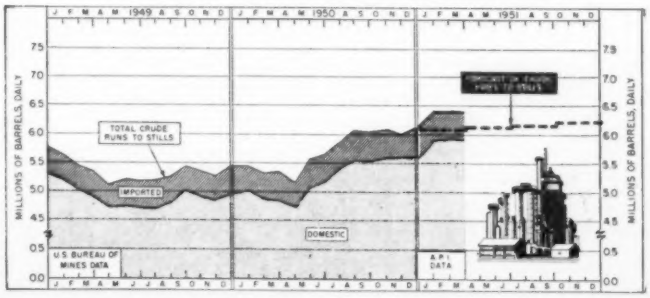
Residual fuel stocks (37,327,000 bbls. for the U. S.) on March 24 represented 26 days' supply in terms of forecast demand. Stocks on March 31, 1950 (41,860,000 bbls.) were 30 days supply and the volume in refinery storage on March 31, 1949, (58,190,000 bbls.) was 47 days' supply.

Gas Liquids Statistics

The Bureau of Mines has changed its monthly reporting on the light liquid hydrocarbons extracted from natural gas, to show production, demand and stocks in units of barrels, in place of gallons as previously. This makes the figures directly comparable with those in the Bureau's monthly report on refinery operations. The report for January shows total production at natural gasoline and cycling plants of 558,000 bbls. daily, which is almost 15% above the rate of production in January, 1950, and about the same as in December, 1950.

Total stocks of natural gasoline and allied products at plants, terminals and refineries increased 119,000 bbls. during the month. All of the increase was accounted for by larger stocks of natural gasoline at refineries, with stocks of products at gasoline plants and terminals actually decreasing by 75,000 bbls.

Fig. 1—First Quarter Runs Well Above Forecast


J F M A M 1949 A S O N D
J F M A M 1950 A S O N D
J F M A M 1951 A S O N D
MILLIONS OF BARRELS DAILY
TOTAL CRUDE RUNS TO STILLS
IMPORTED
DOMESTIC
U.S. BUREAU OF MINES DATA
API DATA
J F M A M J J A S O N D

Crude Runs to Stills

Daily Average (1000 bbls.)

	Domestic	Foreign	TOTAL
March '51 API*	5,945	475	6,420
March '50 BM	4,861	475	5,336
Change	+1,084	000	+1,084
% Change	22.3		22.3

* Through March 24.

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mo. '51*	348,380	31,499	379,879
2 Mo. '50	300,879	26,991	327,870
Change	+47,501	+4,508	+52,009
% Change	15.7	16.7	15.9

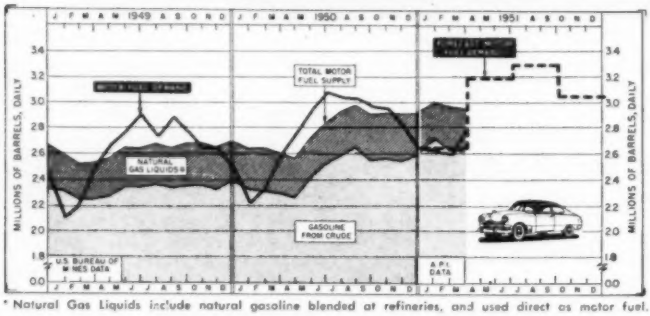
* February from API data.

BM Forecast of Runs to Stills, 1951
(1000 b/d avg., by Quarters)
1st Q., 6,100; 2d Q., 6,130; 3d Q., 6,150; 4th Q., 6,210

Yields on Crude Runs to Stills

	Gasoline	Kerosine	Dist. Fuels	Resid. Fuels
	%	%	%	%
March '51 API	40.7	6.1	20.3	21.1
Feb. '51 API	40.5	6.1	21.8	21.6
Jan. '51 BM	41.0	6.2	21.7	20.8
March '50 BM	43.5	6.1	17.7	21.8

Fig. 2—Motor Fuel Demand Starts Seasonal Rise


J F M A M J J A S O N D 1949
J F M A M J J A S O N D 1950
J F M A M J J A S O N D 1951
MILLIONS OF BARRELS, DAILY
TOTAL MOTOR FUEL SUPPLY
NATURAL GAS LIQUIDS*
GASOLINE FROM CRUDE
U.S. BUREAU OF MINES DATA
A.P.I. DATA

* Natural Gas Liquids include natural gasoline blended at refineries, and used direct as motor fuel.

Fig. 3—Gasoline Stocks Above 140,000,000 Bbls.

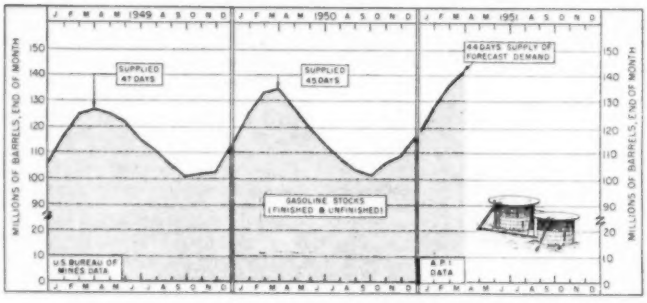

J F M A M J J A S O N D 1949
J F M A M J J A S O N D 1950
J F M A M J J A S O N D 1951
MILLIONS OF BARRELS, END OF MONTH
SUPPLIED 47 DAYS
SUPPLIED 45 DAYS
44 DAYS SUPPLY OF FORECAST DEMAND
GASOLINE STOCKS (FINISHED & UNFINISHED)
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Fig. 4—Seasonal Drop in Heating Oil Demand

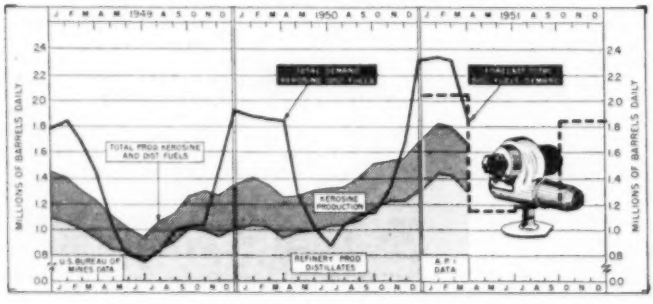
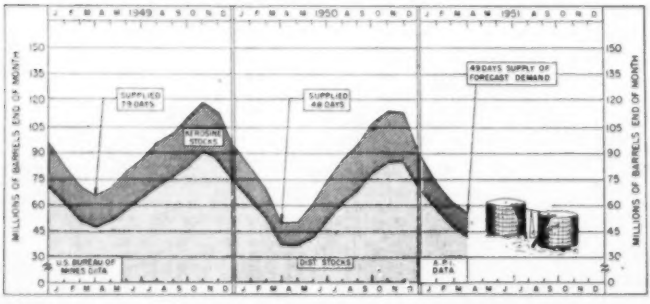

J F M A M J J A S O N D 1949
J F M A M J J A S O N D 1950
J F M A M J J A S O N D 1951
MILLIONS OF BARRELS DAILY
TOTAL PROD KEROSINE AND DIST FUELS
KEROSINE PRODUCTION
REFINERY PROD DISTILLATES
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Fig. 5—Heating Oil Stocks at 1950 Low Point


J F M A M J J A S O N D 1949
J F M A M J J A S O N D 1950
J F M A M J J A S O N D 1951
MILLIONS OF BARRELS END OF MONTH
SUPPLIED 79 DAYS
SUPPLIED 48 DAYS
49 DAYS SUPPLY OF FORECAST DEMAND
KEROSINE STOCKS
DIST STOCKS
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Motor Fuel Supply

Daily Average (1000 bbls.)

	Gasoline from Crude	Natural Blended Used Direct	TOTAL
March '51 API*	2,610	350	3,960
March '50 BM	2,301	305	2,606
Change	+309	+45	+354
% Change	13.4	14.8	13.6

* Through March 24.

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mo. '51*	156,207	20,743	176,950
2 Mo. '50	137,241	18,588	155,829
Change	+18,966	+2,155	+21,121
% Change	13.8	11.0	13.5

* February from API data.

Motor Fuel Demand

Including Exports
Daily Average (1000 bbls.)

March '51 API*	2,805
March '50 BM	2,595
Change	+210
% Change	8.1

* Through March 24.

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mo. '51*	155,852
2 Mo. '50	133,814
Change	+22,038
% Change	16.5

* February from API data.

BM Forecast of Motor Fuel Demand, 1951
(1000 b/d avg., by Quarters)
1st Q., 2,629; 2nd Q., 3,187; 3rd Q., 3,372; 4th Q., 3,043

Gasoline Stocks

Finished and unfinished, end of month (1000 bbls.)

March '51 API*	141,239
Feb. '51 API	137,634
Jan. '51 BM	128,226
March '50 BM	133,766

* On March 24.

Heating Oils Production

(Kerosine and Distillates)
Daily Average (1000 bbls.)

	Kerosine	Dist. Fuels	TOTAL
March '51 API*	285	1,300	1,685
March '50 BM	326	938	1,264
Change	+59	+362	+421
% Change	18.1	38.6	33.3

* Through March 24.

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mo. '51*	23,768	83,750	107,518
2 Mo. '50	20,609	61,218	81,827
Change	+3,159	+22,532	+25,691
% Change	15.3	36.8	31.4

* February from API data.

Heating Oils Demand

Daily Average (1000 bbls.)

	Kerosine	Dist. Fuels	TOTAL
March '51 API*	370	1,485	1,855
March '50 BM	426	1,411	1,837
Change	−56	+74	+18
% Change	13.1	5.2	0.9

* Through March 24.

Total (1000 bbls.)
(Bureau of Mines Data)

2 Mo. '51*	30,185	107,415	137,600
2 Mo. '50	25,616	84,959	110,575
Change	+4,569	+22,456	+27,025
% Change	17.8	26.4	24.4

* February from API data.

BM Forecast of Heating Oils Demand, 1951
(Kerosine and Distillates)
(1000 b/d avg., by Quarters)
1st Q., 2,030; 2nd Q., 1,145; 3rd Q., 1,195; 4th Q., 1,837

Heating Oil Stocks

(1000 bbls. end of month)

	Kerosine	Dist. Fuels	TOTAL
March '51 API*	13,032	43,626	56,658
Feb. '51 API	12,679	48,076	60,755
Jan. '51 BM	16,673	58,424	75,097
March '50 BM	13,001	37,777	50,778

* On March 24.

Fig. 6—Residual Fuel Demand Remains High

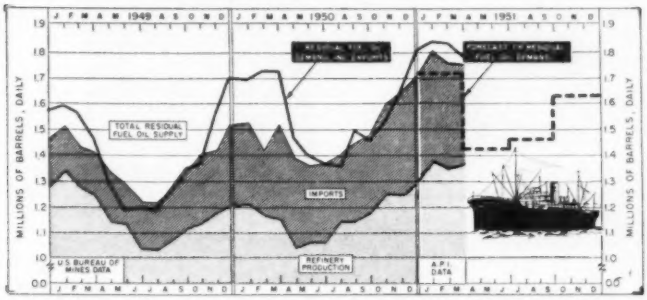
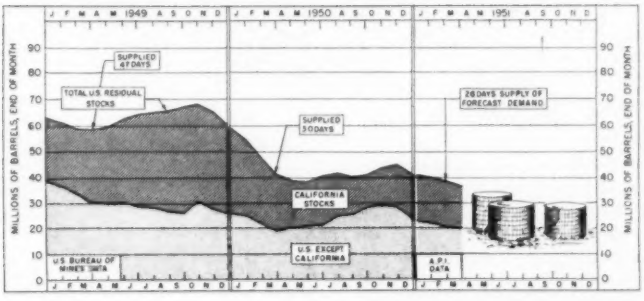

J F M A M 1949 A S O N D
J F M A M 1950 A S O N D
J F M A M 1951 A S O N D
MILLIONS OF BARRELS, DAILY
TOTAL RESIDUAL FUEL OIL SUPPLY
IMPORTS
U.S. BUREAU OF MINES DATA
REFINERY PRODUCTION
A.P.I. DATA

Fig. 7—26 Days' Supply of Residual Fuel Stocks


J F M A M 1949 A S O N D
J F M A M 1950 A S O N D
J F M A M 1951 A S O N D
MILLIONS OF BARRELS, END OF MONTH
SUPPLIED 42 DAYS
TOTAL U.S. RESIDUAL STOCKS
SUPPLIED 30 DAYS
26 DAYS SUPPLY OF FORECAST DEMAND
CALIFORNIA STOCKS
U.S. EXCEPT CALIFORNIA
U.S. BUREAU OF MINES DATA
A.P.I. DATA

Residual Fuels Production

Daily Average (1000 bbls.)

	Refinery Output	Imports	TOTAL
March 51 API*	1,368	382	1,750
March 50 BM	1,154	374	1,528
Change	+214	+8	+222
% Change	18.5	2.1	14.5

* Through March 24.

Total (1000 bbls.) (Bureau of Mines Data)

2 Mo. '51*	80,393	25,322	105,715
2 Mo. '50	70,309	17,188	87,497
Change	+10,084	+8,134	+18,218
% Change	14.3	47.3	20.8

* February from API data.

Residual Fuels Demand

Daily Average (1000 bbls.)

March 51 API*	1,800
March 50 BM	1,732
Change	+68
% Change	3.9

* Through March 24.

Total Demand (1000 bbls.)

2 Mo. '51*	108,549
2 Mo. '50	100,770
Change	+7,779
% Change	7.7

* February from API data.

BM Forecast of Residual Fuels Demand, 1951
(1000 b/d avg., by Quarters)
1st. Q., 1,722; 2nd Q., 1,437; 3rd Q., 1,467; 4th Q., 1,641

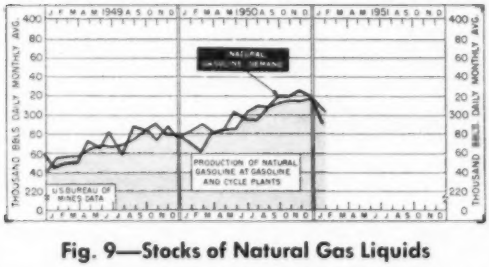
Residual Fuel Stocks

1000 bbls. end of month

	U.S. Except California	Total U.S.
March '51 API*	20,299	37,327
Feb. 51 API	20,703	38,579
Jan. 51 BM	22,926	40,317
March 50 BM	19,423	41,860

* On March 24.

Fig. 8—Production and Demand of Natural Gas Liquids


J F M A M 1949 A S O N D
J F M A M 1950 A S O N D
J F M A M 1951 A S O N D
THOUSAND BBLS DAILY MONTHLY AVG.
NATURAL GASOLINE DEMAND
PRODUCTION OF NATURAL GASOLINE AT GASOLINE AND CYCLE PLANTS
U.S. BUREAU OF MINES DATA

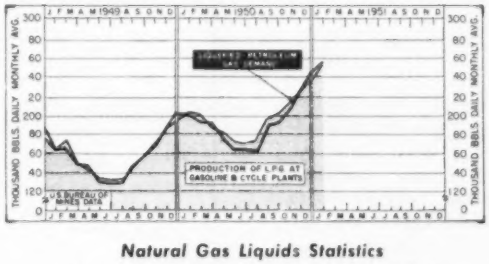
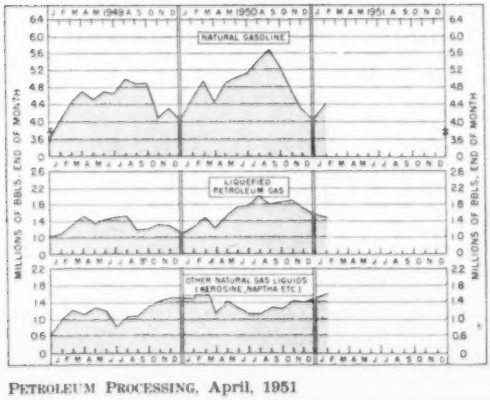

J F M A M 1949 A S O N D
J F M A M 1950 A S O N D
J F M A M 1951 A S O N D
THOUSAND BBLS DAILY MONTHLY AVG.
LIQUEFIED PETROLEUM GAS DEMAND
PRODUCTION OF LPG AT GASOLINE & CYCLE PLANTS
U.S. BUREAU OF MINES DATA

Fig. 9—Stocks of Natural Gas Liquids


J F M A M 1949 A S O N D
J F M A M 1950 A S O N D
J F M A M 1951 A S O N D
MILLIONS OF BBLS. END OF MONTH
NATURAL GASOLINE
LIQUEFIED PETROLEUM GAS
OTHER NATURAL GAS LIQUIDS (KEROSINE, NAPTHA ETC.)

Natural Gas Liquids Statistics

(Source: U. S. Bureau of Mines Report on Natural Gasoline and Cycle Plant Operations)

	Production (1000 bbl./day avg.) Natural Gasoline	LPG**	TOTAL	Demand* (1000 bbl./day avg.) Natural Gasoline	LPG	TOTAL
Jan. '51	305	253	558	297	258	555
Jan. '50	281	205	486	272	204	476
Change	+24	+48	+72	+25	+54	+79
% Change	8.4	23.4	14.8	9.2	26.4	16.6

	Total Production (1000 bbl.)			Total Demand (1000 bbl.)		
12 Mo. '50	109,664	71,894	181,558	109,186	70,984	180,170
12 Mo. '49	99,217	57,869	157,086	99,873	58,208	158,081
Change	+10,447	+14,025	+24,472	+9,313	+12,776	+22,089
% Change	10.5	24.3	15.6	9.3	22.0	13.9

	Stocks, End of Month (1000 bbls.) By Type of Product: Natural Gasoline	LPG	Other Products†	By Location: Refin. ories	Gasoline Plants	TOTAL
Jan. '51	4,496	1,445	1,623	2,462	5,012	7,474
Dec. '50	4,186	1,661	1,507	2,268	5,084	7,344
Jan. '50	4,551	1,266	1,546	2,047	5,316	7,363

* Demand, including exports but not transfers, is supplied from receipts from outside sources as well as current production and stock changes at gasoline plants. Outside receipts in December totaled 176,000 bbls.

** Does not include LPG produced at refineries which in December totaled 3,000,000 bbls.

† Includes naphtha, kerosine, specialty and other products.

ADVERTISERS' INDEX

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

●

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card. . .no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

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(A4) ALUMINUM CO. OF AMERICA .. 412
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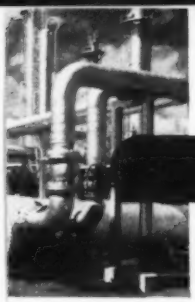
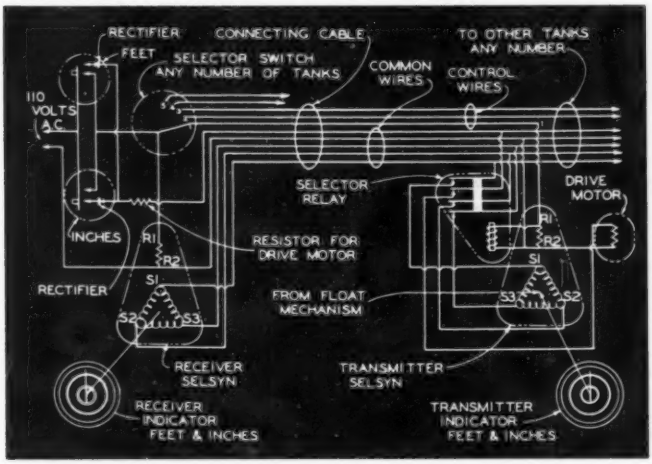


WHAT'S NEW!

Equipment
Materials
Processes
Literature

Reviewed by ***WILLIAM C. UHL, Equipment Editor***

Liquid Level in Storage Tanks Gauged Remotely in Three Seconds, System Consists of Pairs of Self-synchronizing Electric Motors



RAPID REMOTE LEVEL GAGING system shown in schematic circuit

Almost instantaneous readings of 1 to 48 or more storage tanks at a central control point is possible with the new Natasco Model 70 Electric Remote Reading Liquid Level Tank Gauge. The instrument is a simple AC selsyn (self-synchronous) system consisting basically of one selsyn motor in the transmitter at each tank and one selsyn motor in the receiver. The circuit is shown schematically in the diagram. Accuracy is said to be within 1/16 in., and 1 in 360 .

For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage required.

In operation, the transmitter selsyn does not run as a motor. Rather, it is rotated mechanically by a drive motor, the pulley of each motor being connected with a spring belt and operated by conventional float and float line. One receiving selsyn motor can be connected to an unlimited number of transmitters at any and varying distances away. Level in feet and inches is shown on indicating dials on both transmitter and receiver. Calibration of the receiver with transmitter is never necessary because of the permanent synchronization of the two selsyns.

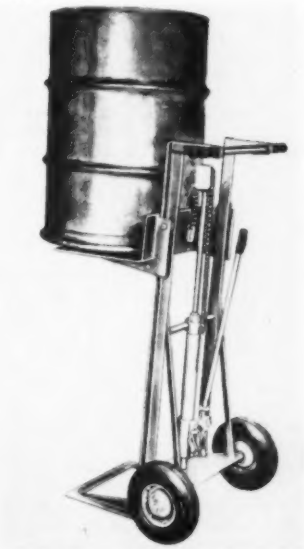
Three seconds are required to gauge a tank. System is not energized until the gauge switch is operated. Transmitter mechanism is immersed in oil and designed for use in Class 1, Group D, hazardous locations. Several types of receivers can be furnished: A) a portable desk type for up to 10 tanks, B) a wall-mounted type for up to 12 tanks, and C) a wall type for up to 48 tanks.

The system requires 110 volt AC power, or it will operate on storage batteries with use of a vibrator-type rectifier. Five wires, usually AWG 18, used common between receiver and each transmitter. One additional control wire is required for each tank. Neither transmitter nor receiver needs adjustment or resetting after a power failure, although tank may have been emptied and refilled during time power was off. Model 70 transmitters can be installed while tanks are in service. The Natasco Co.

Circle No. **1** *on Reply Card*

Hand Truck Will Also Lift and Stack By Use of Built-in Hydraulic Hoist

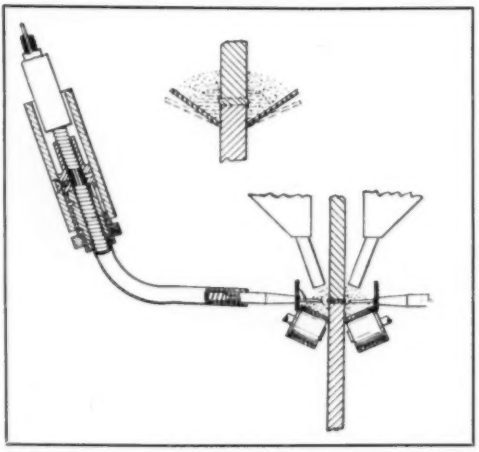
A combination hand truck and stacker with a built-in hydraulic hoist has been developed for loading and unloading heavy cases, drums, barrels, and the like from ground level where loading docks may not be available. It can be handled by one man. The lift stacker weighs 111 lbs. and will raise loads of up to 500 lbs. to a height of 54 in. The plaform is 22 x 19 in. The front of the platform is flush with the floor when lowered. The truck is equipped with 8-in. rubber wheels. Clark-Hopkins Equipment Corp.



Circle No. **2** *on Reply Card*

"3 O'clock" Welding Process Useful for Storage Tank Erection Jobs

Field erection of large outdoor storage tanks is cited as an ideal application for a newly patented automatic hidden arc welding process referred to as "3 o'clock" welding. The plate being welded may be positioned anywhere from flat to vertical, the joint being horizontal. Welds from both sides of the joint can be made simultaneously (see sketch). This reduces actual arc time on a given joint by about 50% and results in lower direct labor costs. Without the new process, "downhand" welding was required for hidden arc automatic work. The process eliminates the need for downhand work and therefore reduces handling and set-up time. Smaller electrode wire can be used also. For example, where on a downhand job a 7/32-in. diameter wire would be used, in a "3 o'clock" position a 3/32 or 1/8-in. electrode is used. Manufacturer says this means: lower currents; less electrode, smaller quantities of flux, welds of reduced cross sectional area. Welds can be on straight seams or following irregular contours. Effects of distortion and cracking are minimized. Tendency for burn through is reduced and back-up strips can be eliminated where two arcs on opposite sides of the work are used. Lincoln Electric Co.



LINCOLN'S "3 o'clock" automatic welding process; joint is stationary, electrodes move, and flux moves on belt

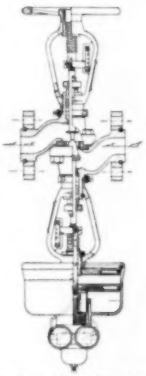
Circle No. **3** *on Reply Card*

Mercury Cleaning and Reclaiming Unit Designed to Handle Small 5-lb. Lots

A small mercury cleaning unit in the "Oxifier" line will handle the metal in 5-lb. lots for those users who require only small quantities of the metal. It was designed as a companion model to a larger 25-lb. Oxifier, and works on the same principle in reclaiming mercury contaminated by dissolved base metals. Powered by an electric motor, it agitates the mercury violently for from 2 to 4 hours and provides maximum air contact with the mercury droplets. As base metal becomes thoroughly aerated, it oxidizes, forms skins, and precipitates out as a metallic oxide powder, which can be readily separated by the small Type G filter. If contamination consists only of floating foreign matter, the small filter will suffice. Operating on the gold adhesion principle, it removes dust, oxide scums, oil, water, and acid residue. The Oxifier unit occupies a table space of 9 x 5 in. and stands 7 in. high. It weighs 8 lbs. Its 1/70 hp motor operates on 115 volt, 60 cycle A.C. The filter weighs 1 lb., 2 oz., and occupies a space of 3½-in. diameter by 6½ in. high. Bethlehem Apparatus Co.

Circle No. **4** *on Reply Card*

Automatic Control Is Combined with Handwheel Operation in New Valve

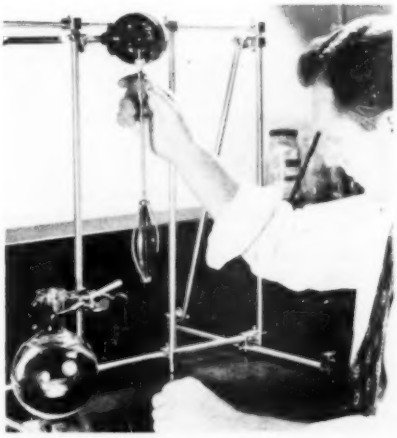


A new Annin Combination Control Valve uses a "Domotor" actuator with a direct acting piston mechanism as the control valve and a Fig. 15 Handwheel - Valve mounted on the underside of the single - seated valve body to provide the versatility of hand operation. When automatic control is desired, the handwheel is opened fully. During start-ups or instrument repair periods, the handwheel provides positive manual control without changing valves. The handwheel may also be used as an adjustable limit stop for the automatic control valve plug. The unit is available out of stock in a wide range of alloys. Pressures to 300 psi. and temperatures of 100° F. can be handled. Annin Valve Co.

Circle No. **5** *on Reply Card*

"Umbrella" Type Flask Stirrer Will Pass through Narrow Necks

Insertion of 4-in. stirrer-propellers through narrow-necked flasks and similar vessels is a problem that can be solved by use of a new "Umbrella Stirrer." It has four blades which can be closed to pass through the neck of the flask and then opened for stirring. The unit is recommended for use with a 3-neck flask when a minimum of exposure to air is desirable. The 12-in. shaft of the stirrer fits the chuck of any motor device accommodating ¼-in. rods. All parts are made of stainless steel. Fisher Scientific Co.



Circle No. **6** *on Reply Card*

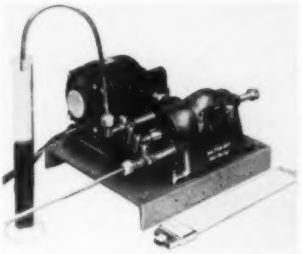
High Capacity Gas Flow Meter Will Handle Pressures up to 1000 psi.

Said to be the first high-capacity, positive-displacement meter capable of handling gas at pressures up to 1000 psi., the No. 2½ Rockwell will enable accurate metering of wide ranges of gas delivery at the take-off point by transmission companies, gas producers, and utilities. Diaphragm-type meters have not been usable above 500 psi. before, it is claimed. The meter weighs 950 lbs., is encased in high-tensile alloy steel castings with 1¼-in. studs (not bolts) joining body and cover. It has capacities of 31,000 and 46,000 cfh. of gas (on a 4-oz. basis) at pressure drops of 6 and 10 in., water column, respectively. The index plate carries combination drillings so that standard indexes (vertical, horizontal, or direct-reading) can be oriented in either of two directions. The meter can be fitted with a 7-day clock-driven combined record gage for conversion of actual to corrected volumes. Ribbing in the body is both internal and external so stresses are distributed uniformly and less metal is required. Alignment is permanent through use of a single support plate for moving and working parts. A 2-in., series 60, ring-joint flange connection is employed, but flat-faced, series 60 flanges can be provided at option of the user. Outside dimensions are 30⅞ in. between connection flanges, 22¼ in. deep, and 26 15/16 in. height to index plate. Rockwell Mfg. Co.

Circle No. **7** *on Reply Card*

Tiny Metering Pump Has Applications For Laboratory or Plant Service

Applications for the new "mini-Pump" include both laboratory and production work. A controlled volume, positive-displacement pump that will handle liquids in the cc./hr. range with accuracy, it can be used for injecting inhibitors in petroleum processing operations, injecting odorants into gases, automatic titration, proportional blending of two or more liquid streams, and continuous sampling. It has a reciprocating plunger of ⅛ inch diameter. A cam, driven by a fractional hp. gear-head motor, actuates the spring-loaded cam follower attached to the plunger. Limiting the travel of the plunger by means of a simple graduated screw adjustment decreases the displacement, thus decreasing the volume delivered. Capacity can be varied with exactness from 3 to 800 cc./hr. Operating pressures are up to 1000 psi. The pump is intended for handling clear liquids. Price of a standard simplex model in Stainless steel with Teflon packing and 440 Stainless steel ball checks is $224. It is available also in Duplex and Multiplex units. Milton Roy Co.



Circle No. **8** *on Reply Card*

DID YOU MISS THESE?

The following items, reviewed originally in the February "What's New!" have aroused considerable interest among readers. They are repeated briefly as a service to those who might have missed them. For details or copies of literature, use the reply card in this issue.

Pythagorean Theorem Basis of Rapid Engineering and Statistics Calculator

Statisticians in quality control, engineering research, etc., will find the Merrill RMS Slide-Disk, a desk calculator, simplifies computing of standard deviations, root-mean-squares, correlation coefficients, regression lines, and the like. Using a graphic method, the device obtains results very rapidly and to an accuracy of 0.5% or better. Five mathematical steps are performed in one two-second mechanical operation. The device consists of a 10-in. disk, sliding and rotating under a pair of vertical and horizontal scales, forming right triangles graphically. Unit has linear and logarithmic scales. Instruction manual is furnished. Graphite Calculator Co.

Circle No. **9** *on Reply Card*

Sight Feed Bubbler or Sediment Trap Designed for Low Flow of Gas or Air

Two new units for metering relatively low flows of gas or air are the King Sight Feed Bubbler and the Sediment Trap. In the bubbler, all the flow passes through liquid in a transparent cylinder, flow rate being shown by rising bubbles. A needle valve permits selecting rates from less than one bubble/second to about 30 cfh. Typical applications include bleeding air into lines to purge them of corrosive fumes, and use with hydrostatic liquid level gages. The trap is identical to the bubbler, but without the needle valve, dip tube, or filler plug. It handles a maximum flow of about 6 cfm. at 25 psi. King Engrg. Corp.

Circle No. **10** *on Reply Card*

Heat Transfer Equipment

Western Supply Co.; 24 pages of information on management, purchasing, and engineering facilities of this company, including engineering data on shell side film coefficients, diagrams of typical exchangers, many being tailor-made for such services as alkylation as well as natural gasoline processes. Western Supply Co.

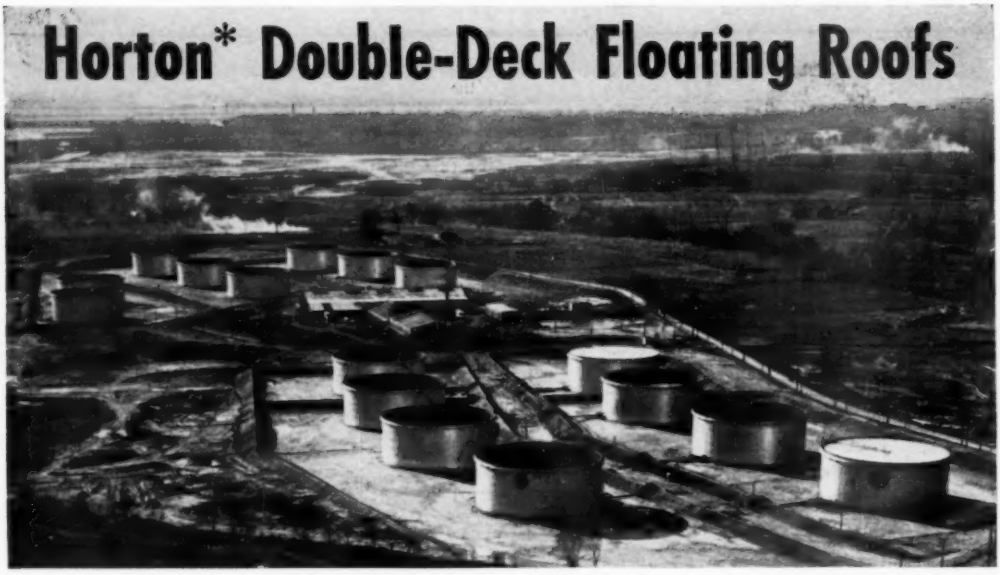
Circle No. **11** *on Reply Card*

Automatic Analytical Instruments

Instruments Accelerate Research, Bulletin 15-14; 84 pages of detailed technical information with schematic drawings, photographs, etc., about infrared, ultraviolet, raman, mass, X-ray spectrometers, polarographs; robotized distillation apparatus; continuous gas analyzers; precision measuring instruments; pressure and force transducers; high vacuum gauges; research apparatus components. Brown Instruments Div.

Circle No. **12** *on Reply Card*

Horton* Double-Deck Floating Roofs



save over 46,000 BARRELS every year at this tank farm!

Each of the 16 tanks shown in the above view at the Gulf Oil Corporation's Darby Creek tank farm near Philadelphia holds 96,000 bbls. of crude oil. The average daily throughput is 103,000 bbls., so each tank is filled and emptied about 26 times per year.

The table at the right indicates the savings Gulf made by equipping each tank with a Horton-Double-Deck Floating Roof. By interpolation, the figures show that each Horton Double-Deck Floating Roof saves 2,000 bbls. annually (compared to a cone roof tank) in *filling* evaporation losses. The estimated saving of *breathing* losses from each crude oil tank is 900 bbls. annually. Totalling the two, *each* Horton Double-Deck Floating Roof at Darby Creek saves about 2,900 bbls. annually in breathing and filling losses. That amounts to about 46,000 bbls. annually for the entire tank farm.

A construction feature had much to do with making these impressive savings. It's the Horton seal that is used to close the space between the deck of a Horton Floating Roof and the tank shell. It's an exclusive feature—and the best device ever invented for preventing the escape of vapor around the edge of a floating roof.

How many barrels can the Horton Double-Deck Floating Roof save on your gasoline or crude oil tanks? Bulletin B has the answer. Write for a copy.

EVAPORATION LOSS IN BARRELS OF 42 U.S. GAL.

TANK SIZE	*Gastight Cone Roof*		*Horton Floating Roof*	
Capacity in Barrels	*Annual Breathing*	*One Filling*	*Annual Breathing*	*One Filling*
10,000	150	8	32	0
20,000	268	16	46	0
30,000	375	24	57	0
40,000	480	32	64	0
50,000	575	40	70	0
60,000	672	48	78	0
70,000	763	56	84	0
80,000	848	64	88	0
100,000	1,030	80	100	0

The losses shown in the above table are based on a Mid-Continent Crude having an API gravity of 38 degrees. The cone roof tanks average one-third full.

NOTE: All of the plates in the tanks shown above were pickled and painted by the Phoscote process. This process removes the mill scale and thus provides a clean surface for painting. It also deposits on the steel a thin coating of iron phosphate that is rust-retarding and furnishes a good paint bond. Ask about "Phoscoting" for your next job.

**Trademark Registered in U. S. Patent Office*

CHICAGO BRIDGE & IRON COMPANY

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

Atlanta 3 . . . . . 2103 Healey Building
Birmingham 1 . . . . . 1327 North Fiftieth Street
Boston 10 . . . . . 1029–201 Devonshire Street
Chicago 4 . . . . . 2114 McCormick Building
Cleveland 15 . . . . . 2215 Guildhall Building
Detroit 26 . . . . . 1532 Lafayette Building
Houston 2 . . . . . 2130 National Standard Building
Los Angeles 17 . . . . . 1526 General Petroleum Building
New York 6 . . . . . 3310–165 Broadway Building
Philadelphia 3 . . . . . 1630–1700 Walnut St. Building
Salt Lake City 4 . . . . . 530 West 17th South Street
San Francisco 4 . . . . . 1559–200 Bush Street
Seattle 1 . . . . . 1330 Henry Building
Tulsa 3 . . . . . 1620 Hunt Building
Washington 6, D. C. . . . . 1135 Cafritz Building

REPRESENTATIVES AND LICENSEES

Horton Steel Works, Fort Erie, Ontario, Canada
Ateliers et Chantiers de la Seine Maritime Paris, France
Constructions Metalliques de Provence, Arles-sur-Rhone, France
Chicago Bridge & Iron Company, Ltd., Apartado 1348 Caracas, Venezuela
Compagnia Tecnica Industrie Petroli, Rome, Italy
Whessoe Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Comprimo N. V., Amsterdam-O, Netherlands
Sociedade Chibridge de Construccoes Ltda., Rio de Janeiro, Brazil

What's New!

New Processed Waxes Won't Melt—Even at their Combustion Temperature

A series of processed waxes have been developed which will not melt even if heated to the combustion point. Such waxes as paraffin, petrolatum, japan wax, beef tallow, beeswax, candelilla, carnauba, ouricuri, and others have been treated successfully to give them this property. Shown in the photograph is an untreated paraffin wax compared with a specially processed paraffin on a hot plate at approximately 600° F. Slightly harder than the unprocessed wax, the non-melting materials have a higher softening point, but never reach the melting stage. Solubility is unchanged. Flexrock Co.

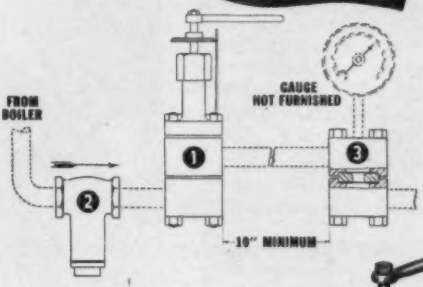
Circle No. **13** *on Reply Card*

Fast Inspection and Easy Maintenance Provided in Breather Valve for Tanks

A new vacuum-pressure breather valve for bulk storage tanks, designated Fig. ST-3695R, has been developed for long life, dependability, and quick access to the interior for inspection and cleaning. Valve pallets and pallet seats are of thermosetting, molded, phenolic resins, said to provide resistance to shock and corrosion. The cover for both the vacuum and the pressure valves is cast in one single unit. It is attached to the body by a swinging yoke which mounts a thumb screw that tightens down against the cover to hold it in place. Shand & Jurs Co.

Circle No. **14** *on Reply Card*

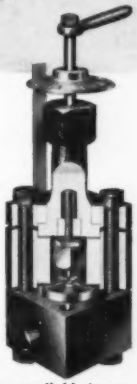
Custom-Built...
CONTINUOUS BLOWDOWN



STRONG Dual-Orifice Assembly gives Greater Accuracy . . . Rugged Service!

Strong's Continuous Boiler Blowdown Assembly includes a Strong *block steel* Evrtyte* Valve (1), a strainer (2) and an orifice block (3), *custom-built* and accurately sized for *your own job conditions.*

The assembly is essentially two orifices arranged in series. The first orifice (valve) is variable . . . . the second is fixed. Correct proportioning of orifices provides extremely accurate control and reduces wire drawing.



Also available in outside screw and yoke.

Strong Evrtyte steel valves have special Anum-Metl X seats and discs of 750 Brinell surface hardness for long life. Available for pressures to 1500 psi and temperatures to 800° F. or 6000 psi non-shock cold service.

Let us custom-size your continuous blowdown system. Send for Catalog No. 68-Q and our Continuous Blowdown Check-Chart today!

*Reg. Trade Mark

STRONG, CARLISLE & HAMMOND COMPANY

1392 WEST 3rd Street
Cleveland 13, Ohio

† ANUM-METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

Reducing Valve

80 Series Trap

Strainer

STRONG

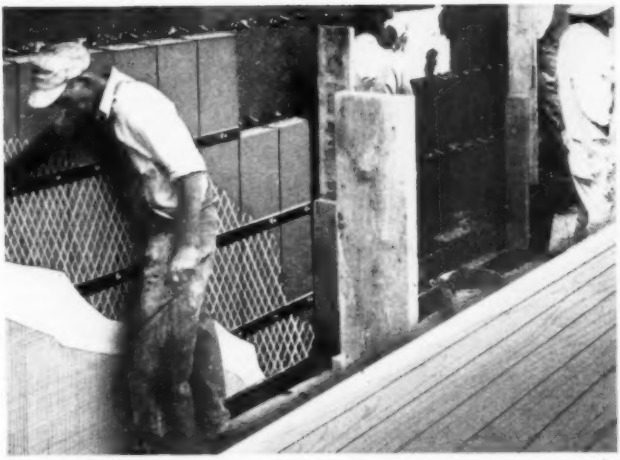
(To obtain more data on advertised products see page 432)

B-L TUBE-SUPPORTED WALLS ELIMINATE STEEL

Tube-supported wall enclosures for boilers—developed and first used in 1942 by Bigelow-Liptak—eliminate supporting steel, yet provide all the advantages of unit-suspended enclosures.

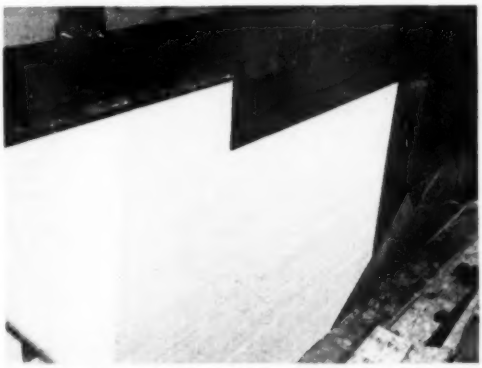
All components—castings, refractories, insulation and casing—are supported by boiler tubes. Each tile is held individually and can easily be replaced. Cumulative refractory loadings and expansion are not possible, and heat losses and air infiltration are minimized.

Tube-supported walls reduce the initial cost. Not only is structural steel eliminated, but thinner refractories and economical insulation thicknesses are employed. Steel plate casings are not needed with B-L's new Texad* finish.



Construction sequence is shown in this retouched photo. Supporting castings are fastened to studs which are field welded to the tubes. Block insulation, sandwiched between layers of plastic, seals the job. Metal lath and insulation battens hold the block in place. Weatherproof Texad* provides the finish.

The crew is now fastening to the retainers the castings and refractories. After the insulation has been applied . . .



. . . **Texad* covers** the enclosure. The job goes up quickly, costs less, saves steel, holds maintenance to a minimum.

Reserve your copy of B-L's new tube-supported wall catalog. Write today on your letterhead.

*Trademark

BIGELOW LIPTAK Corporation

BIGELOW-LIPTAK

Unit-Suspended Walls & Arches

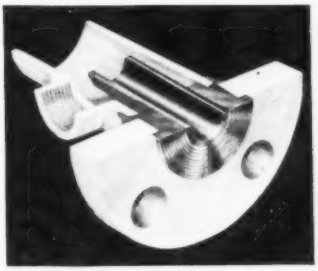
CURTIS BUILDING • DETROIT 2, MICHIGAN

IN CANADA

BIGELOW-LIPTAK OF CANADA, LTD., TORONTO, ONTARIO

ATLANTA • BOSTON • BUFFALO • CHICAGO • CLEVELAND • DENVER • DETROIT • HOUSTON • KANSAS CITY, MO. • LOS ANGELES • MINNEAPOLIS • NEW YORK PITTSBURGH • PORTLAND, ORE. • ST. LOUIS • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SAULT STE. MARIE, MICH. • SEATTLE • TULSA • VANCOUVER, B.C.

What's New!



Full Corrosion Resistance, Less Alloy Provided in Heat Exchanger Design

Lowered cost with no reduction in the use of alloys where they are needed for corrosion resistance is said to be a feature of the new Econalloy heat exchanger design. As shown in the photograph, the alloy materials are being used only as flange inserts and for the inner tube which is in contact with the fluid or vapor being heated. The joint is made without welding. The alloy inner tube had been expanded into prepared serrations in the I. D. of the insert flange by torque limit tools which prevent undesirable stresses. The Econalloy line is furnished in sizes from a fraction of a square foot of heating surface to several hundred square feet, in lengths up to 30 ft. per segment. Internal tube sizes range from ¼ to 4 in. Standard units are available for pressures to 900 psi. and temperatures in excess of 700° F. Martin-Quaid Co.

Circle No. **15** *on Reply Card*

Deflection Type Instrument Produces Six Permanent Records on One Chart

Production is now under way on a new Multipoint Capacilog, an electronically operated unit which is a deflection type strip chart recorder providing up to six permanent records

3 aids for refinery engineers

PROVE YOUR EQUIPMENT IS TIGHT

Model 24-101A Consolidated Leak Detector can detect and *locate* leaks as small as one cc. of air in 30 years. Utilizes helium as a testing medium. Vessels can be tested under either vacuum or pressure conditions. Extremely portable—can be used anywhere that 60 cycle 115 volt power is available. This small mass spectrometer combines extreme sensitivity with absolute reliability. With it, the most stringent government and industrial specifications for leak-free components can be met with ease.

For further information write for Bulletin CEC-1801-X26

FOR RAPID, ACCURATE MIXTURE ANALYSES

New Model 21-103 MASS SPECTROMETER is an improved successor to the instrument so extensively used by every major refiner. Now, more than ever, can plant operations be aided by the precise, rapid analyses of complex mixtures of gases and liquids obtainable only with this versatile analytical tool.

Control or exploratory analyses for:

INORGANIC GASES	
Paraffins / *Aromatics*	*through C 12*
Naphthenes / *Olefins*	*through C 10*
Diolefins / *Acetylenes*	*through C 6*
Substituted Organic Compounds	

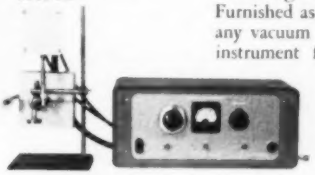
For further information write for Bulletin CEC-1800-X30

PRECISELY MEASURE GAS PRESSURES IN THE MICRON RANGE

Model 23-105 Consolidated Micromanometer accurately measures gas pressure in the 0-150 micron range *without knowledge of the composition of the gas.* The pressure readings are independent of the fact that gas might be air, a condensable vapor, or an unknown mixture. Pressure changes as small as 0.1 microns can be detected. Because of this, special calibration charts for each gas are eliminated.

Furnished as a complete unit ready for installation in any vacuum system, the micromanometer is an ideal instrument for measuring static pressures in high vacuum stills and crystallizers; or measuring the pressure of gases of unknown or variable composition.

For further information write for Bulletin CEC-1819-X7



CONSOLIDATED ENGINEERING

Corporation

Analytical Instruments — *for Science and Industry*

300 N. Sierra Madre Villa — *Pasadena 8, California*

(To obtain more data on advertised products see page 432)

on one chart. Measurement may be obtained with sensing units producing electric signals, such as thermocouples, radiation detectors, etc. The deflection type system is a direct reading non-balancing method of detecting changes in a measured variable that achieves results obtainable before only through use of potentiometric or null type systems. Accuracy is 0.25% of scale. Manufacturer states deliveries on original orders are expected first of April. Schedules of from four to five weeks are estimated after that time. Wheelco Instruments Co.

Circle No. **16** *on Reply Card*

Thread and Gasket Compound Stands Temperatures from —350 to 2900° F.

"Led-Plate" is a newly developed anti-seizing, metallic thread compound said to be effective at temperatures ranging from —350 to +2900°F. or higher. It is designed primarily for pipe, bolt and stud threads and gasket faces where a combination lubricant and sealer are needed. The metallic elements, of which over 70% is powdered lead, are held in suspension in hydrocarbons. The material will not dry out, according to the manufacturer. The compound can be used for oil, water, air, steam, gas, ammonia, and various chemical materials. Armite Laboratories.

Circle No. **17** *on Reply Card*

HOW TO COMBAT
SPIRALING COSTS
Improper water conditioning resulting in corrosion, scale, biological fouling or a host of other troubles, is one sure way to pile up high operating costs in any plant. That's why it's so important—and so profitable—to do something about it now!
If you are cost-conscious about the results you expect from cooling water conditioning, BETZ can be of assistance to you. Here in one organization you will find the facilities and services necessary for the efficient solution of your particular water problem. Our nationwide staff of engineers is ready to serve you. May we have a BETZ Engineer call? He'll show you how you can get results in your plant . . . quickly . . . economically. And, there is no obligation on your part. Write today. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa.
BETZ
COOLING WATER CONDITIONING • BOILER WATER CONDITIONING

Trade Literature

Conserving Critical Metals

Lunkenheimer Cast Steels and *Lunkenheimer Copper Base Alloys;* two comprehensive booklets designed to aid in the conservation of critical materials by suggesting how to get maximum service from piping equipment. The Lunkenheimer Co.

Circle No. **18** *on Reply Card*

Longer Life from Condenser Tubes

Life Extension for Condenser Tubes, a 28-page brochure giving technical information on the causes and means of combatting corrosion in copper and copper alloy condenser tubing; including a table of general service recommendations for various alloys. Revere Copper and Brass, Inc.

Circle No. **19** *on Reply Card*

Laboratory Equipment

Labitems, Vol. 1, No. 1; the first issue of a new company publication presenting articles of general interest to users of laboratory equipment; including catalog information on some items in the manufacturers line of products. Emil Greiner Co.

Circle No. **20** *on Reply Card*

Storage Tank Foundations

The Water Tower, March, 1951, contains an informative three-page article discussing the design of foundations for oil storage tanks. Chicago Bridge & Iron Co.

Circle No. **21** *on Reply Card*

Process Control by Refractories Index

New Apparatus Provides Process Control by Measuring Refractive Index, Data Sheet No. 11.0-4; describes the new "Precision-Dow" Robomatic Refractometer using a Brown "Air-o-Lin" Controller for controlling continuous operations such as petroleum fractionation and many others. Brown Instruments Div., Minneapolis-Honeywell Regulator Co.

Circle No. **22** *on Reply Card*

(To obtain more data on advertised products see page 432)

Corrosion Inhibitors

Proposed Applications of "Kontol" in Refineries and Gasoline Plants; 20 page booklet on an organic corrosion inhibitor and its uses in controlling process unit corrosion; for example, heat exchangers, fractionators, etc. Tretolite Co.

Circle No. **23** *on Reply Card*

Petroleum Motion Pictures

Movies About Oil, 2nd Edition; a catalog of motion pictures of general interest about petroleum; giving contents and running times, and telling where prints may be borrowed or rented. Oil Industry Information Committee, API.

Circle No. **24** *on Reply Card*

Water Treatment

Precipitating Softener and Coagulator, Type CM, Bulletin W-212-B6; a six-page folder describing a hydraulically motivated system in which energy for floc preparation is mechanical. Worthington Pump and Machinery Co.

Circle No. **25** *on Reply Card*

Air or Water Cooling

Hudson TP Cooling Towers, 22 pages of descriptive and technical data on water-cooled cooling towers; and *Hudson Air Cooled Units;* an 8-page booklet on induced draft air units for steam and hydrocarbon vapor, jacket water, or gas cooling. Hudson Engrg. Corp.

Circle No. **26** *on Reply Card*

High Pressure Valves

Barksdale Manual Valves, Catalog 1B-1; covers a line of Shut-off, Selector and Manipulator valves for pressures to 6000 psi., explaining the patented "Shear-Seal" principle which provides for fluid flow through the center and never across the sealing surfaces. Barksdale Valves.

Circle No. **27** *on Reply Card*

Piping Engineers Data Card

TF Dimensional Data Card of Welding Fittings and Flanges, consolidates on two sides of an 8½ x 11 in. card specifications on fittings for every nominal pipe size from ½ through 30-in., and flanges for nominal sizes from ½ through 24 in. Taylor Forge & Pipe Works.

Circle No. **28** *on Reply Card*

Helical Pin Heat Exchange Units

The G-R LK-Fin Cooler, Bulletin 1020; 20 pages describing, with complete engineering data, a new design of helically-finned heat transfer equipment developed specifically for cooling lubricating oil, jacket water, transformer oil, quenching oil, and similar services. Griscom-Russell Co.

Circle No. **29** *on Reply Card*

Helpful Corrosion Data

Beyond Your Blueprints, a 16-page catalog on steel and alloy plate fabrication of tanks and vessels for petroleum and chemical processing; including a helpful table listing the resistance values of 16 commonly used metals with reference to several hundred chemical compounds. Nooter Corp.

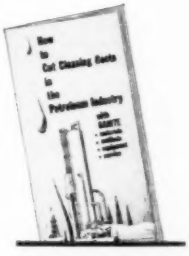
Circle No. **30** *on Reply Card*

Steel Pipe Manufacture

Spang "CW" Steel Pipe. Bulletin No. 370; 32 pages giving a picture story of the continuous welding process for making steel pipe, plus the various finishing operations; includ-

TANK CAR INTERIORS

cleaned faster to speed up turnaround



SEND for this FREE Booklet. It is full of useful information on general maintenance cleaning. Covers all divisions of the Petroleum Industry—production, processing, transportation, marketing.

WITH the Oakite Interior Tank Cleaner you can count on much greater availability of tank cars. This unit cuts tank car cleaning time 70%. It eliminates manual brushing, scraping and steaming-out. With this completely automatic cleaning unit you can condition light-oil carriers in ½ to 1 hour. Crude, creosote or asphalt carriers take from 1 to 3 hours.

Contact your local Oakite Technical Service Representative for complete installation details on this scientifically designed mechanical spray-detergent cleaning method. Or write Oakite Products, Inc., 44C Thames Street, New York 6, New York for illustrated folder F-7679.

Technical Service Representatives in Principal Cities of U. S. & Canada

OAKITE

TRADE MARK REG. U.S. PAT. OFF.

SPECIALIZED INDUSTRIAL CLEANING
MATERIALS • METHODS • SERVICE

(*To obtain more data on advertised products see page* 432)

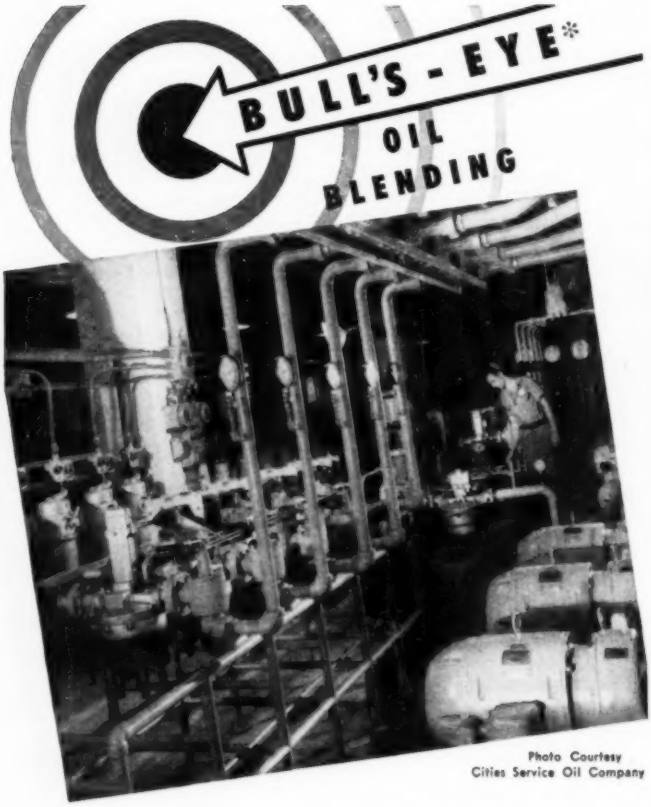


Photo Courtesy
Cities Service Oil Company

with the **BOWSER AUTOMATIC PROPORTIONING SYSTEM**

- **Blends without heat—does not change color of oil.**
- **Blends additives with oil.**
- **Eliminates oxidation caused by air agitation.**
- **Blends at operating pressure of processing plant, assuring retention of volatile additives.**
- **Accurately proportions two or more liquids in percentages as low as ½%.**
- **Patented precision volumetric meter control makes ingredient variations mechanically impossible. Failure of liquid supply to any meter automatically stops entire system.**

***The extreme and unvariable accuracy of the Bowser Proportioner is accomplished by the Bowser Xacto meter—world-famous for accuracy and dependability.**

Write today for complete information.

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What's New!

ing tables of dimensions, weights, test pressures, threading data, and bundling schedules on black and galvanized pipe in standard sizes from ⅛ to 4 in. Spang-Chalfant Division, National Supply Co.

Circle No. **31** *on Reply Card*

Valve Welding End Specifications

Valve Values, Vol. 11, No. 36; includes a table of valve welding end specifications developed from various current standards for flanges, pressure piping, fabrications, etc., and designed for use as a handy desk top reference. Edward Valves, Inc.

Circle No. **32** *on Reply Card*

Gasoline Storage Tank Cleaning

Tank Talk, a 50-page, pocket size booklet concerned with safe procedures for entering and cleaning leaded gasoline tanks, and safe removal and disposal of sludge; in cartoon pictorial style similar to many of the World War II Armed Forces manuals. Du Pont Co., Petroleum Chemicals Division.

Circle No. **33** *on Reply Card*

Water Softening Equipment

Cochrane Zeolite Softeners featuring the Hydromatic Single Control Valve, Publication 4520; a 32-page bulletin explaining the sodium zeolite softening process, giving data necessary for laying out a plant, sizing information, and details on the accessory equipment. Cochrane Corp.

Circle No. **34** *on Reply Card*

Fire Brick Withstands 3000° F.

JM-3000 Insulating Fire Brick, a four-page folder presenting economic advantages, industrial applications, and refractory properties of a new product, said to be first insulating fire brick for sustained use at 3000° F. Johns-Manville.

Circle No. **35** *on Reply Card*

Safety with Chlorine

Handling of Liquid Chlorine, an 8 x 11 in. chart with 20 suggested safe practices in the use of liquid chlorine, covering employe protection, leaks, accidents. Pennsylvania Salt Mfg. Co.

Circle No. **36** *on Reply Card*

Maintenance Cleaning

Facts About Removing Carbon, Grease, Dirt, Paint; a 24-page pocket-size booklet covering the use of Oakite solvent detergents in general cleaning operations in all types of industrial plants. Oakite Products.

Circle No. **37** *on Reply Card*

(*To obtain more data on advertised products see page* 432)

What's New!

High Capacity Compressors

Centrifugal Multi-Stage Compressors, Bulletin 116; 36 pages of thorough catalog information on a line of compressors with capacities from 1000 to 65,000 cfm.; including a detailed six-page section of engineering data and performance characteristics allowing estimation of power requirements, rotative speed, and discharge temperature for most applications. Clark Bros Co., Inc.

Circle No. **38** *on Reply Card*

Liquid Level Instruments

Liquid Level Gauges, Bulletin L700 (replaces Catalog 1015); 24 pages on liquid level instruments for recording, indicating, controlling, and telemetering; in several types, including pressure type, mercury counterpoise, and bubbler. The Bristol Co.

Circle No. **39** *on Reply Card*

Flexible Piping Joints

Flexible Ball Joints, Catalog No. 215; 16 pages of technical information on a line of flexible ball joints in 12 styles, 15 sizes from ¼ to 12 in., for seven different service specifications and six metals for handling temperatures from −50 to 1000° F., pressures from vacuum to 750 psi. steam or 6000 psi. hydraulic, as well as virtually all acid or alkali conditions. Barco Mfg. Co.

Circle No. **40** *on Reply Card*

Micro-Bellows Metering Pump

Corson - Cerveny Micro - Bellows Pump; 12 pages, with diagrammatic sketches, explaining the operation, construction, and application of a stainless steel metering pump in two sizes—15 to 1000 ml./hr., and 30 to 2000 ml./hr. Research Appliance Co.

Circle No. **41** *on Reply Card*

Rubber Compounds and Parts

Stalwart Catalog No. 51SR-1; 16 pages covering 30 different rubber

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Business reply cards are included in each issue of PETROLEUM PROCESSING to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing the first page of this section. Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the bottom of the card and drop it in the mail. No postage required.

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(To obtain more data on advertised products see page 432)

compounds with resistance to abrasion, chemicals, petroleum products and their derivatives, high and low temperatures, and weathering; including a special section on silicone rubbers, and data on typical fabricated parts. Stalwart Rubber Co.

Circle No. **42** *on Reply Card*

Hexagonal Steel Grating

Klemp Open Steel Gratings, Stair Treads, Surface Armor; four pages covering hexagonal and other style steel grating useful for stair and walkway safety treads, and also for ganister linings for fractionators, reactors, and the like. William F. Klemp Co.

Circle No. **43** *on Reply Card*

Instrument Catalogs

Industrial Thermometers, Catalog 100; *Dial Type Thermometers,* Catalog 200; *Pressure Gauges,* Catalog 300; and *Recorders,* Catalog 400; contain complete technical information, specifications, etc. on company's line of instruments. Gotham Instruments, Div. of American Machine & Metals, Inc.

Circle No. **44** *on Reply Card*

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Literature Offered in this Issue's Advertisements

ADDITIVES. Lubricating Oil: Literature and samples: American Cyanamid Co. See Adv't. p. 334.
CIRCLE NO. **L2** *ON REPLY CARD*

ADDITIVES. Lubricating Oil: Technical Bulletin No. 0-56: Monsanto Chemical Co. See adv't. p. 341.
CIRCLE NO. **L3** *ON REPLY CARD*

ADDITIVES. Lubricating Oil: Technical Bulletin No. 0-66: Monsanto Chemical Co. See adv't. p. 341.
CIRCLE NO. **L4** *ON REPLY CARD*

ADDITIVES. Lubricating Oil: Technical Bulletin No. 0-67: Monsanto Chemical Co. See adv't. p. 341.
CIRCLE NO. **L5** *ON REPLY CARD*

ADDITIVES. Lubricating Oil: Technical Bulletin No. 0-68: Monsanto Chemical Co. See adv't. p. 341.
CIRCLE NO. **L6** *ON REPLY CARD*

ALLOYS: Bulletin: Ampco Metal, Inc. See adv't. p. 350-351.
CIRCLE NO. **L7** *ON REPLY CARD*

ALLOYS: Booklet entitled "Hastelloy High-Strength, Nickel-Base, Corrosion-Resistant Alloys": Haynes Stellite Co. See adv't. p. 357.
CIRCLE NO. **L8** *ON REPLY CARD*

BLENDING CALCULATOR, for Du Pont TEL Compound: Bulletin A-1210: Du Pont Co., Inc. See adv't. facing p. 360-361.
CIRCLE NO. **L9** *ON REPLY CARD*

BLENDING EQUIPMENT, Continuous: Literature: "Proportioneers, Inc." See inside front cover.
CIRCLE NO. **M1** *ON REPLY CARD*

BLOWERS, Axial Flow: Publication No. 90: The Standard Stoker Co. Inc. See adv't. p. 408.
CIRCLE NO. **M2** *ON REPLY CARD*

BOILER BLOWDOWN VALVES: Catalog No. 68-Q and Continuous Blowdown Check-Chart: Strong, Carlisle & Hammond Co. See adv't. p. 437.
CIRCLE NO. **M3** *ON REPLY CARD*

CENTRIFUGAL PUMPS: Bulletins: Pacific Pumps Inc. See adv't. p. 338.
CIRCLE NO. **M4** *ON REPLY CARD*

CENTRIFUGAL PUMP, close-coupled vertical: Bulletin B-592: Peerless Pump Division, Food Machinery and Chemical Corp. See adv't. p. 358.
CIRCLE NO. **M5** *ON REPLY CARD*

CONDENSER TUBES: Technical Bulletins: Wolverine Tube Division of Calumet & Hecla Consolidated Copper Co. See adv't. p. 342.
CIRCLE NO. **M6** *ON REPLY CARD*

CONTROL VALVES: Bulletin 750 entitled "Control Valve Sizing Data": Minneapolis-Honeywell Regulator Co. See adv't. p. 409.
CIRCLE NO. **M7** *ON REPLY CARD*

CONTROL VALVES: Catalog 700-2: Minneapolis-Honeywell Regulator Co. See adv't. p. 409.
CIRCLE NO. **M8** *ON REPLY CARD*

COOLING TOWERS: Article entitled "Cooling Tower Studies": The Fluor Corp., Ltd. See adv't. p. 332-333.
CIRCLE NO. **M9** *ON REPLY CARD*

COOLING TOWERS: Article entitled "Evaluating Cooling Tower Performance": The Fluor Corp., Ltd. See adv't. p. 332-333.
CIRCLE NO. **N1** *ON REPLY CARD*

CYCLING JET PUMPS: Bulletin 5030: Penberthy Injector Co. See adv't. p. 447.
CIRCLE NO. **N2** *ON REPLY CARD*

DU PONT SERVICES: Bulletin No. A-663: Du Pont. See adv't. facing p. 360-361.
CIRCLE NO. **N3** *ON REPLY CARD*

FLOATING ROOFS, double deck: Bulletin B: Chicago Bridge & Iron Co. See adv't. p. 436.
CIRCLE NO. **N4** *ON REPLY CARD*

FLOATING ROOFS: Bulletin entitled "Wiggins Hidek Floating Roof" General American Transportation Corp. See adv't. p. 330.
CIRCLE NO. **N5** *ON REPLY CARD*

FLOW METERS, positive displacement: Bulletin 40-B-14: Roots - Connersville Blower Corp. See adv't. p. 413.
CIRCLE NO. **N6** *ON REPLY CARD*

HEAT EXCHANGER TUBES: A 24-page booklet: Aluminum Co. of America. See adv't. p. 396.
CIRCLE NO. **N7** *ON REPLY CARD*

JET PUMPS: Bulletin 5080: Penberthy Injector Co. See adv't. p. 447.
CIRCLE NO. **N8** *ON REPLY CARD*

LEAK DETECTOR: Bulletin CEC-1801-X26: Consolidated Engineering Corp. See adv't. p. 439.
CIRCLE NO. **N9** *ON REPLY CARD*

MASS SPECTROMETER: Bulletin CEC-1809-X30: Consolidated Engineering Corp. See adv't. p. 439.
CIRCLE NO. **O1** *ON REPLY CARD*

MICROMANOMETER: Bulletin CEC-1819-X7: Consolidated Engineering Corp. See adv. p. 439.
CIRCLE NO. **O2** *ON REPLY CARD*

MIST ELIMINATORS: Booklet entitled "Metex Mist Eliminators" Metal Textile Corp. See adv't. p. 443.
CIRCLE NO. **O3** *ON REPLY CARD*

MIXERS, Side Entering: Catalog No. 600: Eastern Industries, Inc. See adv't. p. 425.
CIRCLE NO. **O4** *ON REPLY CARD*

OXYGEN RECORDER: Bulletin 50-82^{a} and O_2-CO_2 Comparison Graph: The Hays Corp. See adv't. p. 344.
CIRCLE NO. **O5** *ON REPLY CARD*

PACKING: Durametallic Corp. See adv't. p. 446.
CIRCLE NO. **O6** *ON REPLY CARD*

PROCESS CONTROLLERS: Details on M-40 Controller: The Foxboro Co. See adv't. p. 356.
CIRCLE NO. **O7** *ON REPLY CARD*

REFRACTORIES: Technical Bulletin SZ1 on Stabilized Zirconia: Norton Co. See adv't. p. 348.
CIRCLE NO. **O8** *ON REPLY CARD*

SAFETY HEADS: Catalog: Black, Sivalls & Bryson, Inc. See adv't. p. 398.
CIRCLE NO. **O9** *ON REPLY CARD*

STEAM TRAPS: Bulletin 450: W. H. Nicholson & Co. See adv't. p. 422.
CIRCLE NO. **P1** *ON REPLY CARD*

STEAM TRAPS: Bulletin T-1746: Yarnall-Waring Co. See adv't. p. 421.
CIRCLE NO. **P2** *ON REPLY CARD*

STORAGE TANK CLEANING: Bulletin No. A-1134: Dupont Co. See adv't. facing p. 360-361.
CIRCLE NO. **P3** *ON REPLY CARD*

SUMP PUMPS, explosion proof: Bulletin 4929: Penberthy Injector Co. See adv't. p.447.
CIRCLE NO. **P4** *ON REPLY CARD*

TANK CLEANING: Illustrated folder F-7679: Oakite Products, Inc. See adv't. p. 441.
CIRCLE NO. **P5** *ON REPLY CARD*

TANK HEATERS: The Griscom-Russell Co. See adv't. p. 354-355.
CIRCLE NO. **P6** *ON REPLY CARD*

THREAD COMPOUNDS: Free sample and data sheet: Felt Products Mfg. Co. See adv't. p. 399.
CIRCLE NO. **P7** *ON REPLY CARD*

VALVES, instrument piping and general use: Literature entitled "Data Unit on General Use Valves" Jerguson Gage & Valve Co. See adv't. p. 406.
CIRCLE NO. **P8** *ON REPLY CARD*

WELDING FITTINGS: New catalog entitled "Bonney Weldolets" Bonney Forge & Tool Works. See adv't. p. 337.
CIRCLE NO. **P9** *ON REPLY CARD*

PERSONALS

Alexander Fraser, chairman of the executive committee and a director of Shell Oil Co., has retired after 32 years with the company.

Mr. Fraser

A native of Glasgow, Scotland, Mr. Fraser took his first job with the Pumpherston Oil Co., one of the pioneers in Scotland's shale oil enterprises. In 1910, a new association with the General Asphalt interests took him to the Trinidad oil fields. A few years later, he was transferred to General Asphalt's head office in Philadelphia, with responsibility for supervising the company's interests in both Trinidad and Venezuela. During World War I he served as Secretary of the Inter-Allied Petroleum Council, with headquarters in London.

The war over, Mr. Fraser returned to the United States, where he joined the Shell organization in 1919. He held various executive positions with Shell until 1933, when he became president of the Shell Petroleum Corp. In 1939, when the Shell companies in the east, mid-continent, and on the west coast were consolidated into a single company, Mr. Fraser was made president of Shell Oil Co., Inc. He became president of Shell Union Oil Corp., the holding company, in June, 1947. In September, 1949, Shell Union absorbed Shell Oil and took the name of Shell Oil Co. At that time, Mr. Fraser became chairman of the executive committee of the new company.

* * *

E. V. Hodge has been appointed superintendent of a new natural gasoline plant now being constructed at Ringwood, Okla., for the Warren Petroleum Corp. Hodge formerly was superintendent at Warren's Salem, Illinois, plant. **Homer M. Trout,** previously office manager of Warren's Monument plant in New Mexico, has been named chief clerk of the new Ringwood plant.

* * *

Dr. Louis Schmerling, research chemist of the Universal Oil Products Co., Chicago, was given the $1,000 Precision Scientific Co. Award in Petroleum Chemistry during the Cleveland Session of the American Chemical Society's 119th national meeting.

The award was presented to Dr. Schmerling at a general meeting Monday evening, April 9, in the Cleveland Public Auditorium. His award address, on "The Mechanisms of the Reactions of Aliphatic Hydrocarbons," was delivered during a technical session of the Society's Division of Petroleum Chemistry the following morning.

* * *

Dr. Kenneth K. Kearby has been appointed senior research associate by the Standard Oil Development Co. in recognition of his achievements in the chemistry of synthetic rubber and high octane gasoline. Dr. Kearby's elevation to senior research associate is in line with the company's policy of conferring professional titles upon employees who have rendered outstanding service in technical fields.

Mr. Kearby

Dr. Kearby, who has been associated with Standard Oil Development since 1937, specializes in catalytic research in the firm's laboratories at Linden, N. J. The company described his work as of "considerable importance" in the production of high octane gasoline and butadiene, a component of synthetic rubber.

A graduate of the University of Illinois, he received his M.S. degree there in 1933, a fellowship one year later, and his Ph.D. in chemical engineering in 1937, shortly before joining Standard Oil Development Co.

* * *

William P. Gee, vice president of Texaco Development Corp., has been promoted to assistant to the president of The Texaco Co.

Mr. Gee

Mr. Gee attended the University of Texas and Massachusetts Institute of Technology. He entered the oil business in 1919, and was first employed by The Texas Co. in 1927 as a research chemist in the Port Arthur, Texas, Refinery. He has been actively engaged in the development and commercialization of many of the processes licensed by company. Until his appointment Mr. Gee has been engaged in the process licensing for Texaco Development Corp.

* * *

Andrew Kalitinsky, former chief engineer of the Nuclear Energy for Propulsion of Aircraft Project, has been appointed manager of the M. W. Kellogg Co.'s Special Projects Department.

Mr. Kalitinsky

One of the youngest men ever to receive the honor, Mr. Kalitinsky was awarded the Manly Memorial Medal in 1949 by the Society of Automotive Engineers for his paper, "Atomic Power and Aircraft Propulsion."

Mr. Kalitinsky was educated at the Swiss Federal Institute in Zurich. On coming to the United States, he joined the staff of the Massachusetts Institute of Technology, and later engaged in development work with Pratt & Whitney Aircraft. Mr. Kalitinsky served with the United States Navy Bureau of Aeronautics during the war, before joining Fairchild Engine and Aircraft Co. to head the NEPA Project, and is at present a consultant to the U. S. Air Force.

His work at Kellogg is a natural continuation of his specialization in the field of propulsion. Kellogg is engaged in development work on rockets and rocket fuels in its Special Projects Department, and is also manufacturing rockets employing both solid and liquid fuels.

* * *

T. Nicholas Bath has accepted the position of chief lubrication engineer for the Battenfeld Grease & Oil Corp.

Mr. Bath graduated from the University of Illinois in 1929 with a degree in chemical engineering. He served as a chemist for the Pennsylvania Petroleum Co. and the Kansas City Testing Laboratories before joining the Shell Oil Co. in 1935. When he left Shell Oil in 1950, he was assistant manager of the Lubrication Department in charge of nation-wide industrial lubrication sales.

* * *

Thomas George Reynolds has joined the refinery division of Catalytic Construction Co., Philadelphia, Pa., as an executive engineer. Mr. Reynolds has been closely associated with petroleum engineering since 1929, when he was an engineering inspector at Standard Oil Co. (Ind.) in Whiting, Ind. He was subsequently associated with the M. W. Kellogg Co., Continental Oil Co., Foster Wheeler Corp., Kellex Corp. and J. F. Pritchard and Co., being chief engineer of

the latter company. Prior to joining Catalytic, Mr. Reynolds was a process engineer with United Engineers and Constructors of Philadelphia.

Mr. Reynolds was graduated from University of Illinois with a B.S. in civil engineering in 1928. He was awarded a masters degree in chemical engineering at Columbia University in 1942. Mr. Reynolds is a member of the American Institute of Chemical Engineers, American Society of Civil Engineers, American Chemical Society and is a registered professional engineer in New York.

* * *

Robert H. Williams of the Research and Development Department, Socony-Vacuum Laboratories, Paulsboro, N. J., has been selected to receive a 1951 Incentive Fellowship Award from the company for advanced study.

A similar award went to **James C. Melrose** of the Field Research Laboratories of the Magnolia Petroleum Company, Dallas, Texas, an affiliate of Socony-Vacuum.

Mr. Williams earned a bachelor's degree in geology from the University of Carolina in 1935. This was followed by a master's degree in organic chemistry in 1937 from the same institution.

He joined Socony-Vacuum's Research and Development Laboratories in 1938. Mr. Melrose entered Harvard in 1940 on a scholastic scholarship. After winning a bachelor of science degree cum laude in chemistry at Harvard in 1943, Mr. Melrose became a graduate student in biochemistry and held a teaching assistantship in organic chemistry at the University of Texas in 1946 and 1947, after which he joined the Field Research Laboratories in 1947.

* * *

Mr. Kenney

In March issue (p. 325) we published a personal item on **Bryant F. Kenney** leaving as assistant general superintendent of Esso Standard Oil Co.'s Bayway refinery and joining Standard-Vacuum Oil Co.

Our attention has now been called to the fact that Mr. Kenney in our writeup was incorrectly named Mr. Kennedy, and further that the photograph used and identified as Mr. Kennedy wasn't even Mr. Kenney. How we got all balled up we haven't yet found out—but balled up we certainly did get. And we still don't know the identity of the Mr. Kennedy whose picture we used.

To straighten out the matter, here's the correct picture of Mr. Kenney, who, we have since learned, is chairman and managing director of the newly-formed Standard-Vacuum Refining Co. of South Africa, Ltd., which will construct a 10,000 b/d refinery at Durban, South Africa.

* * *

Carl W. Peters, formerly with Standard Oil Co. (Ind.), has been appointed manager of economics in Pan-Am Southern Corp.'s general office, New Orleans. He was in charge of process economics in Standard's research department and had been with them 22 years before leaving.

In 1941 he was graduated from the University of Virginia with a B.S. degree in chemical engineering and in 1942 received his master's degree in chemical engineering from Princeton University. Following graduation he started with Indiana Standard and was assigned to exploratory studies of refinery operations and refinery planning. In his new position he will be responsible for company economic studies.

Durametalic Packing Wins Test

Sealing 18 Solvents and Diluents

One of the nation's leading valve manufacturers recently conducted a thorough test on the corrosion resistant qualities of three leading brands of packing.

18 solvents and diluents were used in the test as follows: Butyl Acetate, Butyl Cellosolve, Cellosolve, Ethyl Acetate, Bensol Naphtha Med. Boil., Naphtha High Boil., Solvesso No. 2, Toluene, Xylol, Amyl Alcohol, Butyl Alcohol, Ethyl Alcohol, Isopropyl Alcohol, Methanol, Acetone, Methyl Ethyl Ketone and Methyl Isobutyl Ketone.

The packing that proved successful on this 90-day test, (having no leak or corrosion affecting operation), is indicated by the test engineer's report: "A valve suitable for handling solvents, diluents, paint and lacquer thinner should have the following stem packing—DURAMETALLIC NO. 777 NMT."

We will be glad to forward information on this or other types of Durametallic Packings for valve and pump requirements . . . simply write to the Durametallic Corporation, Kalamazoo, Michigan, for Bulletin No. PP-128.

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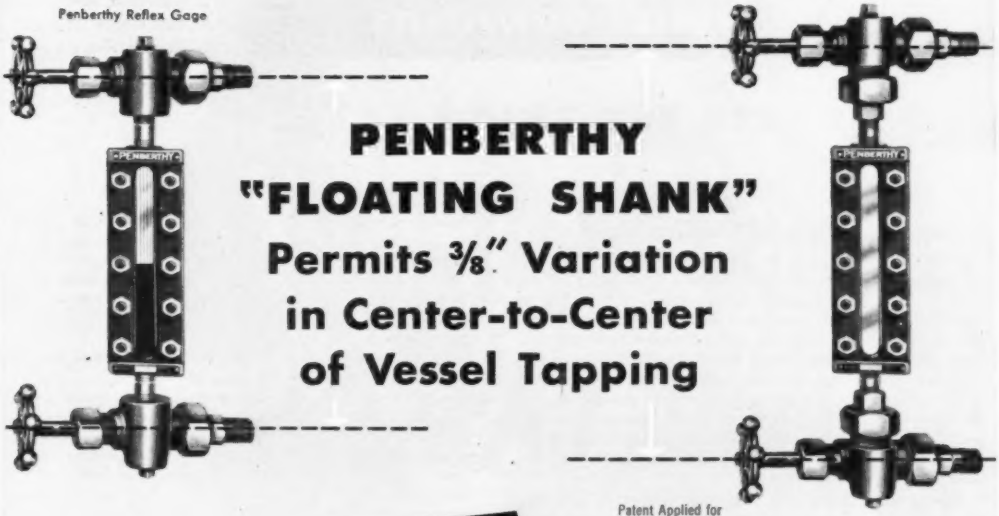

PENBERTHY "FLOATING SHANK" Permits 3/8" Variation in Center-to-Center of Vessel Tapping

Patent Applied for

COMPENSATES FOR VESSEL TAPPING INACCURACIES

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SAVES INSTALLATION TIME

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REDUCES GAGE STRESSES

Another **PENBERTHY** *First*

An important new feature now available on all Penberthy drop forged steel gage valves is the "floating shank" . . . an improvement that has money-saving advantages to many users of liquid level and water gages.

The "floating shank" compensates for inaccuracies in the center-to-center distance of the tapped holes in the vessel on which the gage is mounted. The variation can be as much as 3/8". It provides a mounting flexibility not elsewhere obtainable . . . it saves time during installation of the gage . . . it eliminates stresses that are often induced during mounting.

The Penberthy "Floating Shank" can be had at slight additional cost . . . specify it on your next order for Penberthy drop forged steel (or alloy) gage valves.

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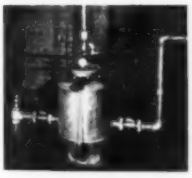

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Motor and switch totally enclosed. Underwriter approved for Class 1, Group D, and Class 2, Groups E, F and G hazardous location. Made of copper and bronze throughout. Ask for Bulletin 4929.

PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Ask for Bulletin 5080.

EDITORIAL VIEWPOINTS

Opinions and Comments on Current Topics

Include All "Natural Gas Liquids"

THE Economics Division of the Bureau of Mines has taken a helpful step by switching from units of gallons to units of barrels in its reporting of statistics on liquid hydrocarbons recovered from natural gas. This change took place with the current report covering January 1951 operations. From the start the natural gasoline companies have dealt in gallons, and many of their transactions with customers will remain in these units. However, the petroleum refiners, their biggest customer, deal in barrels. Thus the figures on the gas liquids, as now reported, are in terms directly comparable with statistics on refinery operations.

Having started to revise its presentation of statistics on the liquid products extracted from natural gas, it is to be hoped the Bureau pursues the subject a bit further, and includes with its monthly data a figure showing the total for lease condensate, which it now reports with crude oil production. The report the Bureau issues entitled "Natural Gasoline and Allied Products" includes the liquid products extracted from the gas in natural gasoline and cycling plants. Lease condensate is different in that it is the liquid extracted or scrubbed from the casinghead gas in the oil field before the gas goes into the pipeline. For the most part it is shipped in the pipeline along with the crude itself and cannot be identified in the form of products. Nevertheless, the lease condensate is a natural gas liquid and the volume produced, at present 80,000 to 85,000 bbls. daily, is a substantial proportion of the total available supply of light liquid hydrocarbons.

The Bureau could entitle its overall report "Natural Gas Liquids," a term the natural gasoline companies are coming to use in place of "Natural Gasoline."

With information on lease condensate added to the data on natural gasoline and cycling operations, the resulting figures would show the total production of natural gas liquids, which is at present not far from 650,000 bbls. daily. This change in reporting would give a more complete picture of how substantial an item the light hydrocarbons are becoming, for the industry either to assimilate in its processing of crude or to market separately as LPG, raw materials for chemical manufacturing, or other products.

Maintenance Has Big Role in Defense

EXCEPT for one factor, most petroleum processing plants can be well prepared for a quick return to operations following any enemy bombing attack. The key to this preparedness is the same as that to reduced downtime on processing units—effective maintenance. It has become routine for today's refiner to have readily available repair parts and working personnel to meet ordinary emergency breakdowns in the plant. This same "know-how" can be utilized in the event of emergencies created by bombing attacks.

The one unfortunate fact is that the refiner's maintenance supplies and shops are most often in the refinery proper and usually centrally located with respect to the main processing areas. For normal peacetime, of course, that is as it should be. On the other hand, falling bombs are not selective. They will not single out processing units for destruction and leave auxiliaries such as maintenance buildings untouched.

It would seem wise, therefore, for refiners to consider making arrangements for separate and additional emergency shops and supplies, located at a safe distance from the plant. Such arrangements might take the form of a simple written agreement with machine shops, equipment suppliers, etc., in the refiner's community. In the case of large cities involving more than one refining company, a pooling effort on the part of the several refiners might be made, selecting one or two emergency "maintenance departments" that could be used by all refiners in the area.

That "ounce of prevention" may be old and trite, but it's still worth a "pound of cure."

Cooling Tower Acceptance Test Needed

THE program of the recently-formed association of cooling tower manufacturers to prepare a standard cooling tower acceptance test procedure should be of great assistance to refiners and natural gasoline manufacturers. It is understood that the association is also working with a subcommittee of ASME's Power Test Code committee, which has the assignment of revising its test code for cooling towers, long overdue.

The new association, The Cooling Tower Institute, has as its general purpose the promotion of better understanding of the functions of cooling towers, and their more efficient utilization in industry. Its ultimate aim is to contribute to the conservation of water supplies, a growing problem in many industrial sections.

At the present time there appears to be no generally used acceptance test procedure for modern cooling equipment, which handicaps plant operators in checking the performance of their own equipment. Possibly when this test method is available, and it is to be hoped that the Institute and ASME tests will be similar if not identical, it will be simple enough that plant operators can be encouraged to use it periodically.

It is a common complaint from tower manufacturers that refiners and gasoline plant operators do not maintain cooling equipment adequately and most trouble calls allegedly stem from this cause. With a simple procedure and educational work on the part of the Institute, perhaps plant operators can be shown the value of running frequent tests to detect incipient trouble before it has gone so far as to require a shutdown to correct. Too often, it is said, no one pays any attention to cooling towers until they give trouble, mainly because the equipment is capable of long operating periods with little or no human attention.

The Institute has the opportunity to make many friends for itself and its members. Already it has made a good start.

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